PB-227 061

THE OHIO RIVER-MC ALPINE POOL REPORT: KENTUCKY-INDIANA

David W. Hill, et al

Environmental Protection Agency
Athens, Georgia

June 1973

DISTRIBUTED BY:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road, Springfield Va. 22151

PB 227 061

031052

THE OHIO RIVER - McALPINE POOL

REPORT

KENTUCKY - INDIANA

Environmental Protection Agency
Surveillance and Analysis Division
Region IV

ATHENS, GEORGIA

JUNE 1973

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
U S Department of Commerce
Springfield VA 22151

THE OHIO RIVER-McALPINE POOL REPORT

KENTUCKY-INDIANA

Environmental Protection Agency
Region IV
Surveillance and Analysis Division
Athens, Georgia

June 1973

This report was prepared under the direction and supervision of Dr. David W. Hill, Chief, Industrial and Special Studies Branch. Mr. Charles A. Sweatt served as Project Engineer for the planning and conduct of the field survey and as principal author of this report. Participating EPA personnel are stationed in Athens, Georgia, as part of the Surveillance and Analysis Division under the direction of Mr. John A. Little, Region IV; and in Evansville, Indiana, as part of Region V.

TABLE OF CONTENTS

Title	Page No.
INTRODUCTION	1
SUMMARY AND CONCLUSIONS	3
RECOMMENDATIONS	9
STUDY AREA	11
DESCRIPTION OF AREA	11
WATER USES AND WATER QUALITY STANDARDS	15
WATER USES	15
WATER QUALITY STANDARDS AND USE CLASSIFICATIONS	15
STUDY METHODS	21
GENERAL	21
MUNICIPAL WASTE	21
INDUSTRIAL WASTE	22
WATER QUALITY STUDIES	22
STUDY FINDINGS	25
WASTE SOURCES	25
Oak Park Conservancy District, Indiana	25
Charlestown, Indiana	28
Hanover, Indiana	30
Madison, Indiana	32
Vevay, Indiana	34
Carrollton, Kentucky	35
Louisville (Hite Creek), Kentucky	35
Dow Corning Corporation, Carrollton, Kentucky	37
M&T Chemicals, Inc., Carrollton, Kentucky	40

Table of Contents (cont'd)

Title	Page No.
Kawneer, Inc., Carrollton, Kentucky.	43
Indiana Army Ammunition Plant, Charlestown, Indiana.	45
Indiana-Kentucky Electric Corporation, Madison, Indiana	46
OHIO RIVER WATER QUALITY	49
FLOW.	49
TEMPERATURE	49
DISSOLVED OXYGEN.	50
BIOCHEMICAL OXYGEN DEMAND	53
TOTAL ORGANIC CARBON.	54
NITROGEN.	56
PHOSPHORUS.	58
pH AND ALKALINITY	58
SPECIFIC CONDUCTANCE.	59
TURBIDITY	59
BACTERIOLOGICAL	59
REFERENCES	67
APPENDIX A - STATION LOCATIONS AND STUDY PLAN.	69
APPENDIX B - CHEMICAL AND BACTERIOLOGICAL METHODS.	83
APPENDIX C - STREAM AND WASTE QUALITY DATA	91
APPENDIX D - REGION V REPORT ON INDIANA ARMY AMMUNITION PLANT.	121
APPENDIX E - ORGANIC COMPOUNDS IDENTIFICATION.	133
APPENDIX F - PERSONNEL ROSTER.	135

LIST OF TABLES

Number	Title	Page
I	MUNICIPAL AND INDUSTRIAL WASTE SOURCES.	16
II	MUNICIPAL AND INDUSTRIAL WATER INTAKES.	17
III	WATER QUALITY CONDITIONS AND SPECIFIC USE CRITERIA APPLICABLE TO OHIO RIVER (McALPINE POOL)	19
IV	MUNICIPAL & INDUSTRIAL EFFLUENT DATA SUMMARY.	26
V	BOD_5 LOADING (LBS/DAY) TO McALPINE POOL	55
VI	SUMMARY OF BACTERIAL WATER QUALITY.	62
VII	SUMMARY OF BACTERIAL WASTE SOURCE DATA.	63

LIST OF FIGURES

Figure	Title	Page
1	Location Map and Sampling Stations.	Fold-out in back (137)
2	Ohio River Navigational Structures.	12
3	Approved Ohio River Water Classification for the McAlpine Pool Reach	20
4	Oak Park Conservancy District, IN, STP.	27
5	Charlestown, IN, STP.	29
6	Hanover, IN, STP.	31
7	Madison, IN, STP.	33
8	Carrollton, KY, STP	36
9	Kawneer and Dow Corning Discharges.	39
10	M&T Chemicals Discharge	41
11	Indiana-Kentucky Power Corp. Ash Pond	48
12	Ohio River (McAlpine Pool), DO, TOC and BOD_5 Concentrations.	51
13	Ohio River (McAlpine Pool), River X-sectional Area, Velocity and K_2 Rate.	52a
14	Ohio River (McAlpine Pool) Average Nitrogen Concentrations	57
15	Ohio River (McAlpine Pool) Total and Dissolved Phosphorus Concentrations.	60
16	Geometric Mean Total Coliform Densities	64
17	Geometric Mean Fecal Coliform Densities	65

INTRODUCTION

Dissolved oxygen concentrations in the lower portion of the McAlpine Pool reach of the Ohio River in violation of Federal and State water quality standards were observed during a survey conducted by the Environmental Protection Agency (EPA) during August and September 1971. Results of that survey are published in the report entitled Ohio River Waste Source and Water Quality, Louisville, Kentucky to Wabash River Reach, Kentucky-Indiana. That report recommended that EPA investigate the causes and recommend solutions to the low dissolved oxygen levels in McAlpine Pool.

A field study was conducted during September 18-24, 1972, with the following objectives:

- Determine the cause of low dissolved oxygen concentrations observed in the lower portion of McAlpine Pool during the August-September 1971 EPA, Region IV, Ohio River Study.
- Characterize the industrial and municipal wastes discharged into the McAlpine Pool reach of the Ohio River.

The 1972 study was conducted by Region IV Surveillance and Analysis Division personnel from Athens, Georgia, with the assistance of EPA Region V personnel from the Evansville District Office.

The cooperation and assistance of the Kentucky Water Pollution Control Commission, the Indiana Stream Pollution Control Board, the Louisville-Jefferson County Metropolitan Sewer District, and the various municipal and industrial entities involved in this study are gratefully acknowledged.

Preceding page blank

SUMMARY AND CONCLUSIONS

Wastewater discharges into the McAlpine Pool reach (River Miles 531.5 to 600.6 -- from upstream to downstream) of the Ohio River are relatively small compared to discharges from the Cincinnati and Louisville areas. The combined effect of waste discharges into the McAlpine Pool, however, tends to retard recovery of the river from the effects of the Cincinnati area waste load.

1. Water quality standards submitted by Indiana and Kentucky have been approved by the Environmental Protection Agency. The McAlpine Pool reach is classified for recreation, aquatic life, agricultural and industrial water supplies except in areas where public surface water supplies are located. These areas are classified for public water supplies by both states. At present, the Louisville Water Company operates the only public surface water supply in the reach. By June 1973, Kentucky is expected to classify all streams for all uses. (The most stringent water quality criteria will apply to all but very limited exceptions.)
2. Of the ten municipal waste sources investigated during this survey, Madison, Indiana, is the largest. The 1.75 mgd flow, containing approximately 20 percent industrial waste, does not receive adequate treatment in the existing overloaded primary treatment facility. Stream standards for coliform bacteria are violated by the discharge from the plant. During the survey, the plant discharged 3,140 lbs/day

of BOD_5, 2,770 lbs/day of suspended solids, 9 lbs/day of total chromium, and total coliform concentrations from 7,300,000 to 86,000,000 per 100 ml.

The sewage treatment plants (STP) at Carrollton, Kentucky, and Charlestown, Indiana, are both primary plants which provide inadequate waste treatment. The Carrollton STP does not provide chlorination. Listed below is the treatment status of all plants surveyed:

Source	Type Treatment	Needs	Implementation Schedule Status
Hite Cr. STP (Louisville)	Tertiary + Cl_2	None	Met
Oak Park Conservancy District STP	Primary + Cl_2	Secondary	Met Secondary facility essentially complete.
Indiana Army Ammunition Plant STP	Primary + Cl_2	Secondary	Secondary facility under construction.
Indiana Army Ammunition Plant STP	Secondary + Cl_2	None	None
Indiana Army Ammunition Plant STP	Septic tanks	Treatment Plant	Funds requested for design and construction.
Charlestown, Indiana STP	Primary + Cl_2	Secondary	Behind Plans Submitted.
Hanover, Indiana STP	Secondary + Cl_2	None	Met
Madison, Indiana STP	Primary + Cl_2	Secondary	Behind Plans approved.
Carrollton, Indiana STP	Primary	Secondary	Plans almost complete.
Vevay, Indiana STP	Secondary + Cl_2	None	Met

3. Five industrial waste sources were investigated. The Indiana Army Ammunition Plant, was closed by a strike and had no discharge during the study. Information on this source is provided in the form of a trip report prepared by Region V personnel and contained in Appendix D. The Indiana-Kentucky Clifty Creek Power Plant discharges approximately 960,000 gpm of cooling water with a 11°F temperature rise. This heat load, if fully mixed, amounts to a calculated 0.42°F temperature rise for the Ohio River flowing at a rate of 30,000 cfs. Chlorine is used for algae control in the cooling system during the summer. This results in a 0.35 ppm chlorine residual in the cooling water discharge for approximately two 30-minute periods per day during the summer. Waste samples were collected from the remaining three industries, all near Carrollton, Kentucky.

   - Dow Corning,
   - M&T Chemicals,
   - Kawneer, Inc.

   The waste samples from M&T Chemicals contained relatively high concentrations of BOD_5 (87.5 mg/1) and ammonia (33 mg/1) which represent a sizable oxygen demand upon the receiving waters. Wastes from Kawneer and Dow Corning had low oxygen demands and probably do not contribute measurably to the low oxygen levels in McAlpine Pool. Domestic wastes from all industries investigated are handled adequately with the

possible exception of Kawneer, Inc. Based on the one effluent coliform sample which exceeded 1,600 per 100 ml, it appears that the septic tank system now employed by the plant may need improvement.

4. Normal waste discharges from industrial and municipal waste sources along the study reach are not sufficiently large to cause the previously observed low dissolved oxygen problems in McAlpine Pool, even though waste treatment is inadequate in several cases. Water temperatures in the river were decreasing during the study and were slightly below the summer peak; however, dissolved oxygen levels as low as 4.0 mg/l were observed. Approximately 15 percent of mid-channel observations were less than the required daily average of 5.0 mg/l. Only slight horizontal or vertical stratification was observed. No real cause and effect relationship could be established between any individual or group of waste discharges within the study reach and observed low oxygen levels.
5. Reaeration rates in the sluggish impoundments of the Ohio River and particularly in McAlpine Pool are low resulting in very little reaeration. Dissolved oxygen levels at Markland Dam are markedly depressed by upstream waste sources. They increase steadily downstream in the first 25 miles of the study reach but then decline downstream to McAlpine Dam. This trend corresponds closely with factors affecting reaeration, namely river velocities and cross-sectional

mg/l). DO was lower in the Ohio (5.4 vs. 6.1 mg/l) and BOD_5 was higher in the Ohio (1.8 vs. 1.4 mg/l).

RECOMMENDATIONS

1. All municipal wastes and sanitary waste discharges from industry should receive adequate secondary treatment and disinfection. The following sources are not meeting these criteria and/or are not making significant progress in meeting the federal-state implementation schedules:

    - Madison, Indiana STP,
    - Carrollton, Kentucky STP,
    - Charlestown, Indiana STP,
    - Indiana Army Ammunition Plant septic tank overflow,
    - Kawneer, Inc. septic tank overflow

    Agencies from the appropriate states and the EPA should review each case and take appropriate action to assure compliance with established implementation schedules.

2. As an immediate measure, equipment to provide adequate disinfection should be provided at the Madison and Carrollton sewage treatment plants.

3. Madison should determine the sources of heavy metals to its sewers (possibly the electroplating plant) and require appropriate pretreatment.

4. Upstream waste sources (primarily in the Cincinnati area) must provide better waste treatment before a significant water quality improvement will occur in the McAlpine Pool. Nitrification of these wastes will probably be necessary.

Preceding page blank

STUDY AREA

DESCRIPTION OF AREA

The Ohio River is formed by the junction of the Allegheny and Monongahela Rivers at Pittsburgh, Pennsylvania. It flows southwesterly for 981 miles to the Mississippi River near Cairo, Illinois (Figure 1 - fold out map at rear of report). Although the river flows through a rather narrow valley, it drains 203,910 square miles of the middle eastern portion of the United States. The river forms portions of the boundary between Ohio and West Virginia and separates Kentucky from Ohio, Indiana, and Illinois.

The specific study area was the 75.3 mile reach of the Ohio River between Markland and McAlpine Dams. The terrain is gently rolling and is dominated by agricultural activities. The population is dispersed in rural areas and small towns. Madison, Indiana, with a population of 13,081 is the largest city in the study area. Industrial activity along the reach is sparse.

The Ohio River is an important navigational route serving the eastern central United States. The river was first used for commercial navigation prior to early 1800 when state and private interests began development. Navigation was extended from the mouth to Pittsburgh with completion of a nine-foot deep channel in 1929. Under a modernization program inititated in 1955, the original system of 51 locks and dams are being replaced by 19 high-lift structures (Figure 2).

The average daily flow of the Ohio River at Louisville is

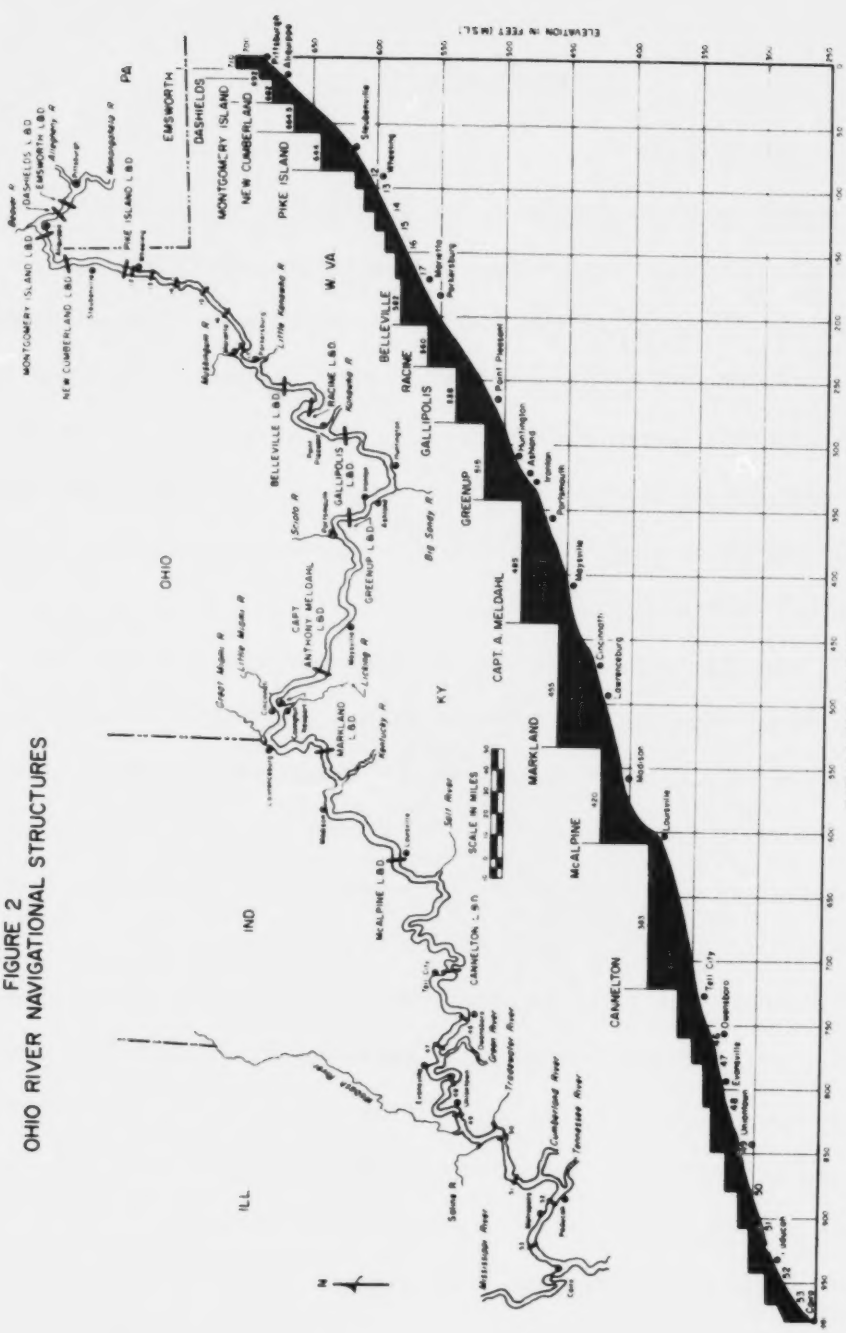


FIGURE 2
OHIO RIVER NAVIGATIONAL STRUCTURES

110,700 cfs for 41 years of record. The ten-year, seven-day low flow of 6,140 cfs and daily average extremes are 1,110,000 and 2,100 cfs.

Preceding page blank

WATER USES AND WATER QUALITY STANDARDS

WATER USES

Water uses within the McAlpine reach consist of public and industrial water supplies, commercial fishing, sport fishing, recreation (including swimming and water skiing), navigation, agricultural and municipal and industrial wastewater disposal. In contrast to upstream and downstream reaches, the McAlpine reach receives very little municipal or industrial waste, increasing its popularity for recreational uses. Municipal and industrial waste discharges are listed in Table I.

Water supplies for one municipality and three industries are taken from this reach of the Ohio River (Table II). Most water supplies in the area are obtained from high production wells in the river valley alluvium. These wells, recharged from the Ohio River, typically produce 1,000 to 2,000 gallons per minute of good quality water.

WATER QUALITY STANDARDS & USE CLASSIFICATIONS

The Federal Water Quality Act of 1965 (Public Law 89-234) provides that States, after public hearing, and prior to June 30, 1967, may adopt water quality standards applicable to interstate waters within the state and an implementation and enforcement plan. The act requires that the standards will protect the public health and welfare, enhance the quality of water, and serve the purposes of this act. In establishing such standards, the state is required to take into consideration uses for public water supplies, propagation of fish and wildlife, recreational purposes, agricultural, industrial and all

TABLE 1
MUNICIPAL AND INDUSTRIAL WASTE SOURCES
Ohio River (McAlpine Pool) Study

River Mile	Municipality	1970 Population	Ave. Flow (MGD)	Type of Treatment	Treatment Status and Federal Implementation Date	Receiving Stream
597.6	Oak Park Conservency Dist. - Indiana	Serves 2,000	0.23	Primary and Chlorination	Secondary facility 90% complete on 6/72. Implementation date for completion - 12/73.	Unnamed tributary to the Ohio River.
595.9	Louisville, Jefferson County Metropolitan Sewer Dist. Hite Cr. Plant, KY	Approx. 75% of waste flow is from Ford Motor Co.'s Truck Assembly Plant	1.5	Tertiary and Chlorination	No needs identified.	Hite Cr., Harrods Cr., Ohio River
593.4	Indiana Army Ammunition Plant		0.25	Secondary and Chlorination	No needs identified.	Ohio River
592.8	Indiana Army Ammunition Plant	160	0.02(e)	Septic tanks w/no drain field	Unsatisfactory - Scheduled to be replaced by two package aeration treatment units in FY '73.	Ohio River
591.5	Indiana Army Ammunition Plant		0.08	Primary and Chlorination	Secondary facility now under construction is scheduled for completion in FY '72.	Jenny Lind Run to Ohio River
590.5	Charlestown, Indiana	5,890	0.40	Primary and Chlorination	Unsatisfactory - Plans for secondary facility submitted to state on 9/16/72. Implementation dates for start of construction 12/72 and completion 12/73.	Ohio River
554.7	Kawneer, Inc.	--	0.45	In-plant controls	No needs identified	Ohio River
543.5	M&T Chemicals, Inc.	--	4.8	Neutralization, floculation and sedimentation	Implementation dates for completion of stabilization basins are 3/74. Final plans were completed as required by 9/72.	Ohio River
541.0	Dow Corning Corp.	--	5.02	Sedimentation, neutralization, coagulation and vacuum filtration	Implementation dates for completion of stabilization basins are 6/74.	Ohio River
562.6	Hanover, Ind.	3,018	0.11	Secondary and Chlorination	No needs identified	Ohio River
558.8	Madison, Ind.	13,081	1.75	Primary and Chlorination	Unsatisfactory - Plans for secondary facility approved by state on 4/72. Implementation dates are complete plans 6/71; start construction 12/71; complete construction 12/72	Ohio River
545.8	Carrollton, KY	3,218	0.28	Primary	Unsatisfactory - Implementation dates for secondary facility include completion of plans by 9/72 and completion of construction by 7/74. No progress reported.	Knetucky River
538	Vevay, Ind.	1,463	0.12	Secondary and Chlorination	No needs identified	Ohio River

(e)-Estimate based on population served

TABLE II

MUNICIPAL AND INDUSTRIAL WATER INTAKES
OHIO RIVER - MCALPINE POOL
(NOVEMBER 1972)

Municipalities	Use	Location (River Mile)
Louisville, Ky.	Public Water Supply	600.6
Industries		
Indiana-Kentucky Power Corp., Clifty Creek Plant	Cooling	559.5
Colgate-Palmolive Co., Inc.	Process	603.6
Louisville Gas & Electric Co.	Cooling	603.6
Louisville Gas & Electric Co.	Cooling	604.9

other legitimate uses. The State of Indiana and the Commonwealth of Kentucky have submitted and received approval on their water quality standards. Standards submitted by the water pollution control agencies of both states are applicable to the study reach and enforceable by the two states and the Federal Government. In addition to the standards submitted by the states, the Ohio River Valley Water Sanitation Commission (ORSANCO), a compact representing eight states along the Ohio River, has also adopted criteria for judging the suitability of the Ohio River water for various uses. The ORSANCO standards, however, are not federally enforceable. Table III presents a brief summary of the criteria applicable to the study reach.

Water use classifications for the Ohio River have been proposed by Kentucky and Indiana and approved by EPA. A schematic representation of the study area classifications is shown in Figure 3. A clause in the Indiana standards provides for the classification of public water supply to be applied at existing or future surface water supply points. The reach of river near McAlpine Dam, now classified for aquatic life, was planned to be upgraded in the Kentucky standards to recreation in July 1974. However, a public hearing is scheduled by the Department of Natural Resources and Environmental Protection for June 4, 1973, after which all streams are expected to be classified for all uses. Exceptions will have to be justified by dischargers at public hearings for their discharge permits.

TABLE III

Water Quality Conditions and Specific Use Criteria Applicable to Ohio River (McAlpine Pool)

Minimum Conditions For All Waters At All Times

(1) *Free from substances attributable to municipal, industrial, agricultural or other discharges that will settle to form putrescent or otherwise objectionable deposits.*

(2) *Free from floating debris, oil, scum and other floating material attributable to municipal, industrial, agricultural or other discharges in amounts sufficient to be unsightly or deleterious.*

(3) *Free from materials attributable to municipal, industrial, agricultural or other discharges producing color, odor, or other conditions in such degree as to create a nuisance.*

(4) *Free from substances attributable to municipal, industrial, agricultural or other discharges in concentrations or combinations which are toxic or harmful to human, animal, plant or aquatic life.*

Stream Quality Criteria

Water Use Classification

Public Water Supply (Kentucky) and (Indiana)

Bacteria: Monthly arithmetic mean total coliforms ≤5,000/100 ml (MPN or MF); or, ≤5,000/100 ml in more than 20 percent of samples; or, ≤20,000/100 ml in more than 5 percent of samples.

Threshold Odor Number: <3 after treatment.

Dissolved Solids: <750 mg/l at all times, monthly mean ≤500 mg/l or specific conductance @ 25°C ≤1,200 umhos/cm at all times or monthly mean <800 umhos/cm.

Radioactive Substances: Gross beta activity not to exceed 1,000 picocuries per liter (pCi/l), nor shall activity from Strontium 90 exceed 10 pCi/l, nor shall activity from dissolved alpha emitters exceed 3 pCi/l.

Chemical constituents: Not to exceed the following at anytime:

Constituents	Concentration (mg/l)	Constituents	Concentration (mg/l)
Arsenic	0.05	Cyanide	0.025
Barium	1.0	Fluoride	1.0
Cadmium	0.01	Lead	0.05
Chromium (Hexavalent)	0.05	Selenium	0.01
		Silver	0.05

Recreation (Kentucky)

Bacteria: Total coliform monthly mean ≤1,000/100 ml; daily value ≤2,400/100 ml. If above values are exceeded, during May-October the geometric mean fecal coliform density ≤200/100 ml in ten samples per month or ≤400/100 ml in 10% of monthly samples. During November-April monthly geometric mean ≤1,000/100 ml in ten monthly samples or ≤2,000/100 ml in 10% of monthly samples.

Recreation-Whole Body Contact (Indiana)

Bacteria: April-October, monthly geometric mean fecal coliform ≤200/100 ml in five samples per month or ≤400/100 ml in 10% monthly samples.

-Partial Body Contact (Indiana)

Bacteria: Geometric mean fecal coliform ≤1,000/100 ml or ≤2,000/100 ml in 10% of samples.

Aquatic Life (Kentucky) and (Indiana)

Dissolved Oxygen: (Kentucky & Indiana) Daily average ≥5.0 mg/l with minimum ≥4.0 mg/l.

pH: 6 to 9 (Ky.); 6.0-8.5 (Ind.)

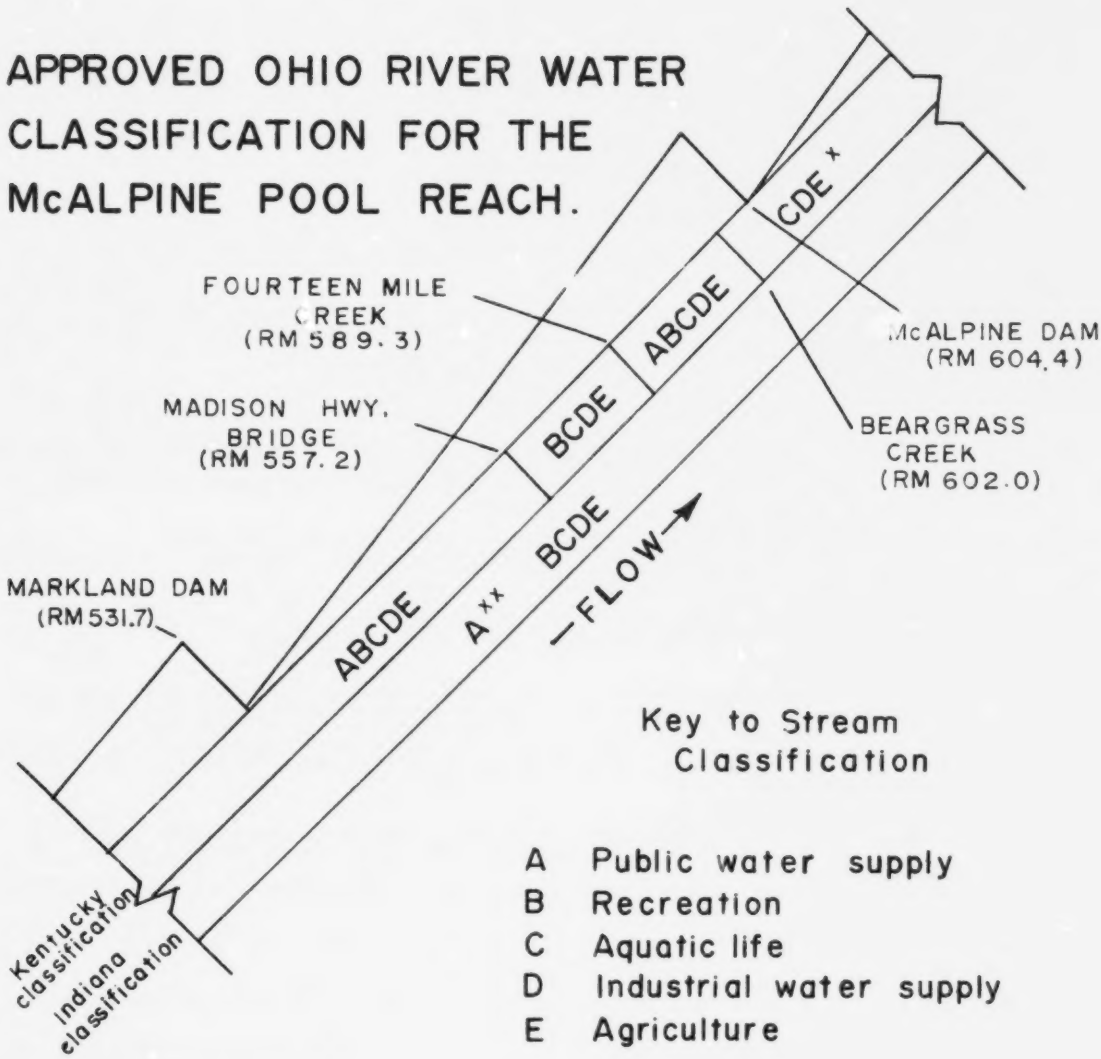
Temperature: (Ky.) Max. 88°F, 5° rise in stream, 3° rise in impoundments. (Ind.) Max. 88°F, 5° rise.

Toxic Substances: (Ky. & Ind.) <1/10 96-hour TLM.

Taste & Odor: (Ind.) No substance which imparts unpalatable flavor to food fish, or result in noticeable offensive odors in the vicinity of the water.

FIGURE 3

APPROVED OHIO RIVER WATER CLASSIFICATION FOR THE McALPINE POOL REACH.



Key to Stream Classification

A Public water supply
B Recreation
C Aquatic life
D Industrial water supply
E Agriculture

x Scheduled for upgrading to recreation classification in July 1974

xx All waters which are now used or will be used in the future for public or industrial water supply must meet the criteria established for those uses.

STUDY METHODS

GENERAL

The study area was limited to the reach of the Ohio River between River Mile 600.6 (Louisville, Kentucky) and River Mile 530.6 (lower end of Markland Pool adjacent to Craigs Creek). All waste sources sampled on the Indiana side of the river were sampled by personnel of the EPA, Region V, Indiana District Office, with the assistance of personnel of EPA, Region IV, Surveillance and Analysis Division. These samples were analyzed at the Evansville field station laboratory. All other waste source and stream samples were analyzed by Region IV personnel at the field laboratory located at the Louisville-Jefferson County, Fort Southworth Sewage Treatment Plant or at the EPA Laboratory in Athens, Georgia.

MUNICIPAL WASTE

One daily effluent composite sample was collected from each of the municipal waste treatment plants discharging into McAlpine Pool. The Madison, Indiana STP was the only facility where influent samples were collected. S ples were collected and composited at hourly or half-hour intervals with EPA automatic sampling equipment. Additional samples requiring special preservation techniques and bacteriological samples were collected as grab samples. All sources except the Louisville Hite Creek STP were sampled prior to post chlorination. Bacteriological samples, however, were collected after chlorination if chlorination was provided. Flows were determined by in-plant flow measuring devices or plant records. Appendix A lists the types

of samples collected and the analyses performed.

INDUSTRIAL WASTE

Two daily composite samples were taken with EPA automatic samplers from each industrial waste source discharging into the McAlpine Pool. One grab sample was taken during each 24-hour period for those parameters requiring special preservation. One or more bacteriological grab sample was collected from each source. Flow measurements were supplied by the companies based on direct measurements or water usage. Appendix A lists the types of samples collected and analyses performed.

WATER QUALITY STUDIES

Samples were collected at 17 Ohio River and tributary sampling stations located upstream and downstream from waste sources, major tributaries, and at intermediate river locations. Seventeen stations were sampled at mid-channel for five consecutive days. Some cross-sectional samples were taken below waste sources and major tributaries to determine the amount of lateral mixing. The criteria for sampling depth, station identification and utilization for each station are contained in Appendix A.

For quarter point samples, each individual sample was analyzed for dissolved oxygen, temperature and pH. For selected stations, each quarter point sample was also analyzed for 5-day biochemical oxygen demand, turbidity, acidity, alkalinity, nitrogen series (NH_3, NO_2 + NO_2, TKN), phosphorus (total and soluble), and specific

conductance. At other stations, samples were composited across the quarter point cross-section as outlined in Appendix A.

All stream samples analyzed for coliform bacteria were collected immediately below the surface (approximately one foot) using a grab technique. When quarter point bacteriological samples were collected, individual samples were returned to the field laboratory. Any compositing was done by laboratory personnel using sterile glassware. Salmonella samples were collected by suspending swabs in the river at selected sites for two to three days. When the swabs were retrieved, they were promptly placed in nutrient broth and analyzed for Salmonella.

Field laboratory analysis of all samples was initiated within six to eight hours of collection. Samples for later analysis at the Athens, Georgia, laboratory were preserved within these time limits. Chemical and bacteriological methods used during this study are contained in Appendix B.

Preceding page blank

STUDY FINDINGS

WASTE SOURCES

Four industrial and ten municipal or domestic waste discharges into McAlpine Pool were investigated. Other sources discharging into the headwaters of tributary streams were not sampled since they have very little effect upon the study objectives. Only effluent (except Madison STP) samples were collected and no attempt was made to assess treatment efficiencies. The locations of waste sources are shown in Figure 1 with sample station descriptions in Appendix A. A summary of waste source data is contained in Table IV with a complete data summary in Appendix C. Individual waste sources are discussed in detail.

Oak Park Conservancy District, Indiana

The Oak Park Conservancy District STP serves a residential community of the Louisville metropolitan area. The primary treatment plant receives an estimated flow of 230,000 gallons per day from 1,063 family units, one general store, and two service stations. After treatment in the spiral digester (modified Imhoff Tank), the waste is chlorinated (Figure 4) and discharged to a small unnamed tributary which flows into the Ohio River at RM 597.6. Construction is essentially complete on two contact stabilization units (Figure 4). When placed in operation, the units designed to operate in parallel should provide adequate secondary treatment for the waste.

One 24-hour composite sample was collected from the influent of the chlorine contact chamber. Three samples for bacterial

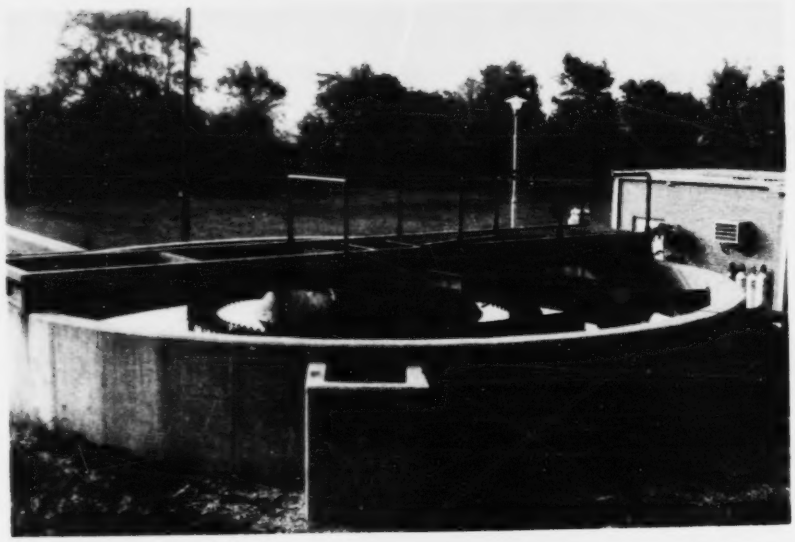
TABLE IV

MUNICIPAL & INDUSTRIAL EFFLUENT DATA SUMMARY
OHIO RIVER (MCALPINE POOL) STUDY
NOVEMBER 1972

Ohio River Mile	Source	Flow MGD	pH	Temp °C	Total Alk $CaCO_3$ mg/l	Total Acidity $CaCO_3$ mg/l	BOD_5 mg/l	TOC mg/l	COD mg/l	Total Solids mg/l	NFLT Solids Total mg/l	NFLT Solids Volatile mg/l	TKN-N mg/l	NH_3-N mg/l	NO_2-NO_3-N mg/l	Total P-P mg/l	Total Coliform/ 100 ml	Fecal Coliform/ 100 ml	T Cr µg/l	TKN µg/l	Cu µg/l	Zn µg/l	Pb µg/l	Cd µg/l	Cr Hex µg/l	Hg µg/l	Ni µg/l	As µg/l
541.0	Dow Corning	5.75	7.4	22.5	243	12	3.7	3.3	29.5	1,924	6	5	0.61	0.12	2.12	0.01	5	< 3	<100	<1,500	48	12	<100	<25	--	--	--	--
543.5	M&T Chemicals,Inc	1.25	7.6	20.3	225	11	87.5	34.0	157	1,904	20	8	36.00	33.00	1.11	0.67	1,263	4	<100	3,200	40	20	<100	<25	--	--	--	--
554.7	Kanneer	0.40	7.4	--	206	11	3.8	1.6	4.2	561	26	22	0.53	0.08	7.60	6.70	<1,600	<800	<100	1,500	68	22	<100	<25	--	--	--	--
538.0	Vevay STP	0.12	7.4	23	305	--	<5	<10	<40	1,100	8	6	1.15	.03	29	11.5	<1,000	<100	50	--	<50	90	<10	<3	<20	--	<100	<15
545.8	Carrollton STP	0.275	7.0	23	--	--	205	106	380	719	66	14	33.00	28.00	0.05	16.7	$87.5X10^6$	$19X10^6$	--	--	--	--	--	--	--	--	--	--
550.8	Madison STP	1.75	7.1	24	305	--	215	122	480	1,225	190	155	24	20	0.15	10.1	$46.6X10^6$	$16.7X10^5$	615	--	--	1,250	66	36	<20	2.9*	<100	<15
562.6	Hanover STP	0.10	7.4	24.5	365	--	93	86	310	1,050	215	175	28	22	0.20	14.5	<100	<10	--	--	125	--	--	--	<20	--	--	--
580.5	Charleston STP	0.40	7.0	23.3	270	--	170	57	290	670	60	55	30	27	0.15	14.5	--	--	<50	--	60	150	38	3	--	0.7	<100	--
591.5	IN Ammo Plt STP	PLANT NOT IN OPERATION DURING SURVEY -- INFORMATION FROM PREVIOUS REPORT CONTAINED IN APPENDIX D																										
592.8	IN Ammo Plt STP	"		"	"		"		"		"	"	"															
593.4	IN Ammo Plt STP	"		"	"		"		"		"	"	"															
595.9	Mite Creek STP	1.5	7.2	--	--	--	13	17	55	650	6	<5	1.21	0.39	0.66	0.80	4	2	<100	<1,500	40	180	<100	25	--	--	--	--
597.6	Oak Park STP	0.23	6.5	23.0	380	--	175	87	400	840	130	105	29	28	<0.10	14.5	$18X10^6$	$10.5X10^5$	--	--	--	--	--	--	<20	--	--	--

*Average for two grab samples

Figure 4



Old Spiral Digester Primary Unit now in Operation at the Oak Park Conservancy District STP

One of the Two New Secondary Units Nearing Completion

analysis were collected from the plant effluent. Suspended solids and BOD_5 were high at 130 mg/1 (244 lbs/day) and 175 mg/1 (328 lbs/day), respectively. Also, chlorination was ineffective with total coliform densities of 16,000,000, 12,000,000, and 27,000,000/ 100 ml observed in the three samples collected.

At the time of the 1972 study, the quality of the effluent was unsatisfactory; however, the new treatment facility now under construction should correct this situation. Federal, state and ORSANCO compliance schedules require:

Completion of plans by	07/72
Start construction by	01/73
Complete construction by	12/73

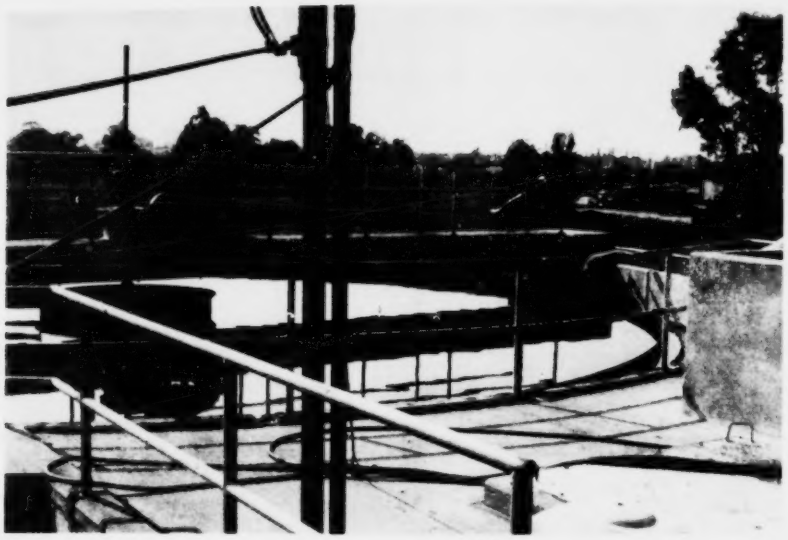
The community is proceeding well ahead of schedule.

Charlestown, Indiana

The city of Charlestown, with a population of 5,890, is served by a primary treatment facility consisting of sedimentation, sludge lagoon and chlorination (Figure 5). The average flow is 400,000 mgd. The treated waste is pumped through a three-mile force main to the Ohio River at Mile 590.5.

A 24-hour composite sample was collected at the Parshall flume used to measure plant discharge. The BOD_5 concentration was 170 mg/1 (567 lbs/day) and suspended solids were 60 mg/1 (200 lbs/day). Bacterial samples were not collected since the force main is used for chlorine contact and the discharge point was not readily accessible.

FIGURE 5



Settling Tank and Sludge Pond at Charlestown, IN, STP

Needs for improvements and upgrading the treatment system have been identified. Federal, state, and ORSANCO compliance schedules require completion of plans by 07/72 and the start of construction by 12/72 with completion by 12/73. Final plans were submitted to the state on 9/16/72.

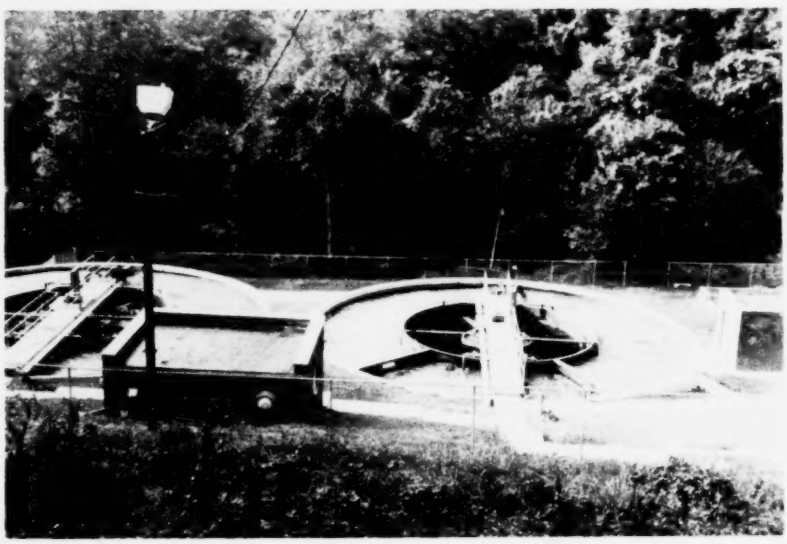
Hanover, Indiana

The city of Hanover, Indiana, and Hanover College are served by a new contact stabilization treatment facility designed for 500,000 gpd (Figure 6), but operating considerably under capacity at approximately 100,000 gpd. The treated waste is chlorinated and discharged via force main to the Ohio River near Mile 562.6.

One 24-hour composite sample was collected from the sedimentation tank just prior to the overflow weir. Two bacteriological samples were collected from a manhole in the discharge line after chlorination BOD_5 concentrations were 93 mg/l (85 lbs/day), and suspended solids were 215 mg/l (192 lbs/day). These values are five to ten times higher than would normally be expected from a plant of this type. It must be assumed that the system was upset and that this sample was not representative of the normal plant effluent. Total coliform concentrations of <100 and <1,000 per 100 ml were determined on two effluent samples with measured chlorine residuals of 1.0 and 0.85 ppm.

Although treatment during the survey was inadequate, no additional treatment needs have been specified. The system is in compliance with the implementation schedule.

FIGURE 6



Secondary STP at Hanover, IN

Madison, Indiana

Madison, Indiana, has a population of 13,081 and is served by a primary sewage treatment plant which discharges into the Ohio River at Mile 558.8 (Figure 7). Besides domestic waste, the 1,750,000 gpd discharged from the facility contains waste from several small industries including a meat packing plant, an electroplating plant, a shoe liner plant, a musical organ plant, and other minor industrial discharges. The industrial waste accounts for approximately 20 percent of the total flow.

Two 20-hour composite samples were collected from the chlorine contact chamber discharge. The chlorine residual at this point was zero when bacterial samples were collected on two different occasions. Total coliform concentrations in the effluent were 86,000,000 and 7,300,000 per 100 ml. The plant operator stated that the chlorinator did not have sufficient capacity to maintain a chlorine residual in the plant effluent. The present dosage and existing chlorinator capacity is 131 lbs/day. BOD_5 concentrations averaged 215 mg/l (3,140 lbs/day), suspended solids averaged 190 mg/l (2,770 lbs/day), total chromium averaged 615 ug/l (9 lbs/day), total copper averaged 125 µg/l (1.8 lbs/day), and mercury levels of 2.9 µg/l (0.04 lb/day) were observed in the plant influent.

The plant effluent constitutes the largest single waste load to the study reach of the Ohio River. It accounts for approximately 43 percent of the combined BOD_5 load from waste sources surveyed. Metals discharged from this plant are excessive and high coliform levels in

FIGURE 7

Settling Tanks at Madison, IN, Primary STP. Indiana-Kentucky Power Corp. Clifty Creek Plant in Background

Digester and Chlorine Contact Tank at the Madison STP. The Underground Discharge is in Approximate Center of the Picture

the river below this plant discharge violate water quality standards.

The city of Madison has been directed to upgrade the treatment facility to provide secondary treatment. The federal and state compliance schedule requires completion of plans by 06/71, start construction by 12/71 and complete construction by 12/72. ORSANCO requires a construction completion date of 12/73. Final plans were accepted by the state on 04/72. Madison is ranked 88th on the 1973 priority list for federal grants. At the present time, the city has indicated that no contract will be awarded until grant funds are received. ORSANCO is pursuing enforcemement action.

Vevay, Indiana

The town of Vevay, Indiana, with a population of 1,463, is served by an extended aeration system similar to the Hanover system shown in Figure 6. After treatment, the 120,000 gpd average flow is chlorinated and discharged to the Ohio River near Mile 538. The only known industry connection is a small shoe factory.

An 18-hour composite sample was collected at the overflow weir from the settling unit. The effluent BOD_5 was less than 5 mg/l (5 lbs/day). Samples collected after chlorination had a total coliform bacteria concentration of less than 1,000 per 100 ml.

No additional treatment needs have been identified and the system is in compliance with federal and state requirements.

Carrollton, Kentucky

Carrollton, with a population of 3,218, is served by a primary sewage treatment system consisting of sedimentation and sludge digestion (Figure 8). Waste flows average 275,000 gpd and contain very little industrial waste. The unchlorinated effluent is discharged to the Kentucky River at Mile 0.7.

A 24-hour composite sample was collected from the settling tank at the overflow weir. The effluent BOD_5 concentration was 205 mg/l (468 lbs/day) and the suspended solids concentration was 66 mg/l (151 lbs/day) and the total coliform density in the effluent was 55,000,000 per 100 ml.

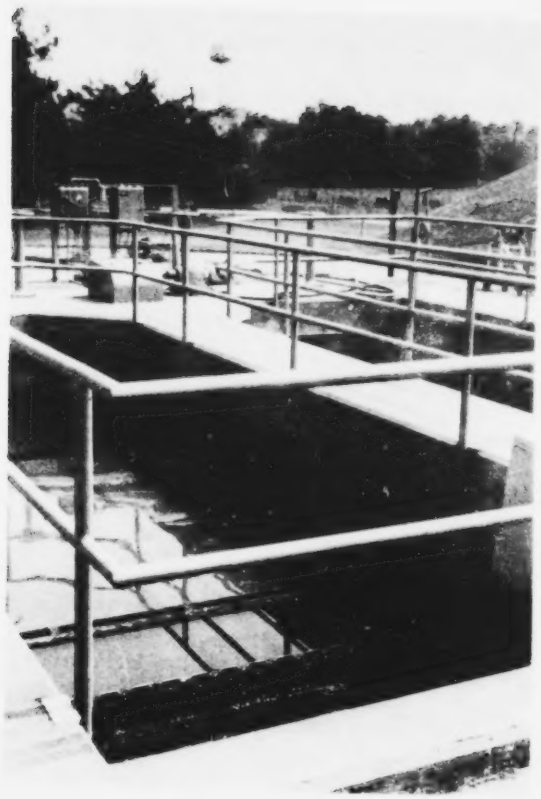
The federal and state compliance schedule requires that plans for a secondary treatment facility be initiated by 2/71 and completed by 9/72. The schedule requires construction to start by 6/73 and be completed by 7/74.

As of April 1973, engineering plans were reported to be 90-95% complete. A few more soil tests were needed to determine if pilings were needed for the foundation. Completion of these plans was anticipated with an additional 30 to 60 days.

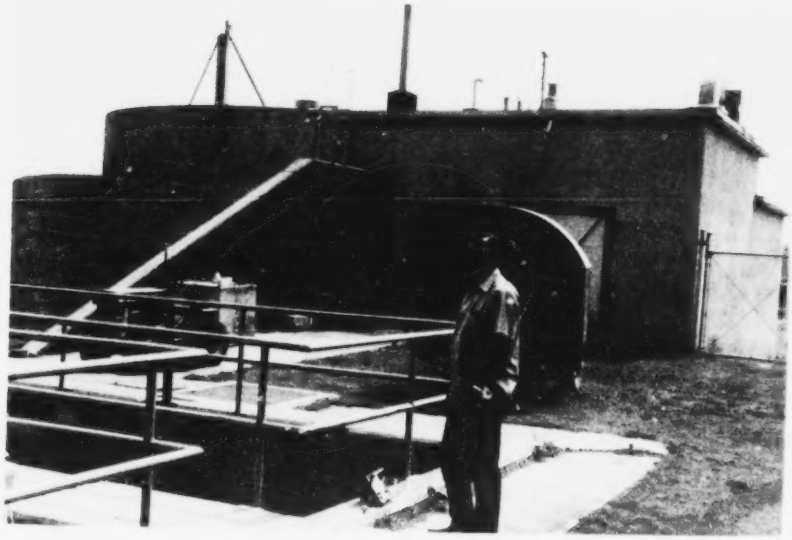
Louisville, Kentucky - Hite Creek Plant

The Hite Creek sewage treatment plant is operated by the Louisville and Jefferson County Metropolitan Sewer District. The plant serves the Ford Motor Company Truck Assembly Plant as well as the residential area in the plant vicinity. Approximately 80 percent of the average daily waste flow of 1.5 mgd comes from the Ford

FIGURE 8



Settling Tank at Carrollton, KY, Primary STP



Digester and Control Building at Carrollton STP

Plant. The remaining 20 percent is from the surrounding residential areas. Weekend flows, when the plant is not in operation, are approximately 0.3 mgd. The tertiary treatment facility consists of an activated sludge secondary system followed by mixed bed filters and chlorination.

The 24-hour composite sample had a BOD_5 concentration of 12.6 mg/l (159 lbs/day) and a suspended solids concentration of 6 mg/l (75 lbs/day). Regular analysis performed by the Louisville-Jefferson County Metropolitan Sewer District indicates that effluent BOD_5's are normally in the 2-5 mg/l range. Metal concentrations in the composite sample (listed below) were low.

Element	Concentration (µg/l)
• Chromium (total)	<100
• Tin	<1,500
• Copper	40
• Zinc	180
• Lead	<100
• Cadmium	25

Dow Corning Corporation, Carrollton, Kentucky

Dow Corning Corporation produces a variety of silicone products for industrial and domestic use. Silicones are used in mold-release agents, rubber products, laminates, encapsulating resins, anti-foaming agents, and water-resistant uses.(2)

The 5.75 mgd average flow from five processing units is collected in equalization ponds, settled, neutralized, coagulated, and discharged

through an underground sewer system to the Ohio River (Figure 9). Domestic waste from approximately 100 employees is treated in a package treatment plant and combined with the process waste before discharge to the river. The effluent is continuously monitored for pH, temperature, and flow. Vacuum filters are used for sludge thickening and the sludge is deposited in a land disposal area.

The combined wastewater discharge from the plant was sampled for two consecutive 24-hour periods using automatic compositing samplers. The average daily waste flows during this period were determined from company flow measuring equipment to be 4,000 gpm. The waste was an almost neutral (pH 7.4), ambient temperature (22.5°C) discharge with low nutrient concentrations. Five-day BOD concentrations averaged 3.7 mg/l (178 lbs/day), total nitrogen concentrations averaged 2.7 mg/l as N and phosphorus concentrations did not exceed 0.01 mg/l. Residue samples indicated that the waste is well settled with an average total residue concentration of 1,924 mg/l and a non-filterable residue concentration of 5 mg/l. Metal concentrations were low:

Element	Concentration (µg/l)
• Chromium (total)	<100
• Tin	<1,500
• Copper	48
• Zinc	12
• Lead	<100
• Cadmium	<25

FIGURE 9

Broken Discharge Flume from Kawneer, Inc., of Carrollton, KY, at the Ohio River Edge

The Discharge from Dow Corning of Carrollton, KY, Flowing into the Ohio River

Bacteriological analysis indicated very low concentrations of total and fecal coliform bacteria with all results less than 4 per 100 ml.

Two organic compounds were detected in the effluent. One, decamethylcyclopentasiloxane, was positively identified at a concentration of 0.023 mg/l. Another actomethylcyclopentasiloxane apparently was present, but no standard was available for verification. The low COD and TOC values found in the waste correspond to the small number of organic compounds found and low concentrations of each.

M & T Chemicals, Inc., Carrollton, Kentucky

M & T Chemicals, Inc., a subsidiary of American Can Company, is the world's leading manufacturer of tin chemicals. The facility at Carrollton produces a variety of industrial organo-tin chemicals. These chemicals have a wide range of use including additives of PVC and vinyl products, algicides and fungicides. Products produced for use in PVC bottles, and films and sheets used in food containers are sanctioned by the U. S. Food and Drug Administration.1/

The 4.8 mgd of process wastes are collected and neutralized in sumps, flocculants are added and the waste is settled through a series of ponds, with the treated effluent discharged to the Ohio River at Mile 543.5 through an underground sewer (Figure 10).

Two samples, a 24-hour composite the first day and a grab the following day, were collected from the plant effluent. The average daily flow of 2,260 gpm had the following concentrations:

1/ M & T Chemicals, Inc. information pamphlet.

FIGURE 10

Waste Discharge from M&T Chemicals, Inc. Entering the Ohio River. The Unstable Shoreline has Eroded

A Closer View of the Eroded Sand and Gravel Shoreline

- pH - 7.6
- Temperature - 20°C
- BOD_5 - 87.5 mg/1
- TKN - 36 mg/1
- NH_3 - 33 mg/1
- $NO_2 + NO_3$ - 1.1 mg/1
- Phosphorus - 0.68 mg/1
- Total Residue - 1,904 mg/1
- COD - 156 mg/1
- TOC - 34 mg/1

This waste source contributed an average of 2,370 lbs/day of BOD_5 or approximately 32 percent of the total measured waste load from all sources. The ammonia load in the waste of 900 lbs/day also represents a large oxygen demand. The relatively low concentration of nonfilterable solids (20 mg/1) indicate that the waste is well settled. Metal concentrations in the effluent are low with the exception of tin, which averaged 3,175 µg/1.

Element	Concentration (µg/1)
• Chromium (total)	<100
• Tin	3,175
• Copper	40
• Zinc	20
• Lead	<100
• Cadmium	<25

Tin, in low concentrations, improves aquatic growth and is not toxic to humans in drinking water.(1) Therefore, tin in this discharge should have no serious adverse effect upon water quality. The total and fecal coliform concentrations were 1,263 and 4 per 100 ml, respectively.

Organic analysis revealed that the following compounds were being discharged to the Ohio River:

	mg/l	lbs/day
• tri-n-butyl-phosphine oxide	<0.1	--
• tri-butyl-phosphine oxide	<0.2	--
• M-xylene	0.15	6.0
• O-xylene	0.09	3.6
• O-cresol	0.13	5.2

Xylene is reported to be toxic and causes taste and odor in water at a concentration of 0.3 to 1.0 mg/l. Since xylene is insoluble in water, the concentration found in the effluent indicates that M & T Chemicals is losing considerable amounts of the chemical.

Kawneer Company, Inc., Carrollton, Kentucky

The Kawneer Company, Inc., is engaged in anodizing, rolling, forming and finishing aluminum trim. The trim material is used primarily in the electric appliance industry and consists of face plates and other thin metal parts requiring special decorative finishes.

An average of 400,000 gpd of waste including treated domestic waste (septic tanks) from 200 shift workers, is discharged from the

plant via an underground sewer to the Ohio River near Mile 554.7 (Figure 9). Plant operations are designed for maximum reuse of water. The spent phosphoric/nitric acid solution from the anodizing tanks is stored and resold to the supplier for use in fertilizer. After dipping in the acid tanks, the metal passes to rinse tanks which utilize recycled cooling water. Wastewater discharged from the process is monitored for pH.

Composite samples were collected from the plant discharge on two consecutive days. Chemical samples were collected before the domestic waste enters the waste stream. Bacteriological samples were collected on the combined waste where the waste enters the Ohio River. Average daily waste flows based on water usage averaged 278 gpm. The industrial waste contained:

- BOD_5 - 3.8 mg/l
- NH_3 - 0.08 mg/l
- Total N - 8.1 mg/l
- Total Phosphorus - 6.7 mg/l
- COD - 4.2 mg/l
- Total Residue - 561 mg/l
- Nonfilterable Residue - 26 mg/l
- Total Coliform - >1,600/100 ml
- Fecal Coliform - >800/100 ml

The waste contribution from this company is small. The BOD_5 load of 13 lbs/day amounts to 0.2 percent of the total waste load measured from all study area sources. However, total coliform

concentrations exceeding 1,600 per 100 ml were higher than anticipated and indicate that some improvement may be needed in the domestic waste treatment. Metal concentrations were low in the effluent and are listed below:

Element	Concentrations (µg/l)
• Chromium (total)	<100
• Tin	<1,500
• Copper	68
• Zinc	22
• Lead	<100
• Cadmium	<25

Indiana Army Ammunition Plant

The Indiana Army Ammunition Plant (IAAP), located near Charlestown, Indiana, is operated under Government contract by Imperial Chemical Industries of America, Inc. (ICI). Under the direction of the U. S. Army, cannon and mortar propellants are loaded and single base propellants are manufactured. The facility has previously operated with an employment of approximately 19,000 but is now down to near 4,500. A major portion of the 1,390 buildings are standing idle. During the recent survey, the workers were out on strike and the operation was shut down, making it impossible to collect waste samples. A brief visit was made to the plant during normal operations in August 1972 in preparation for the survey; however, no waste samples were collected.

The main potential source of industrial wastes is the Propellant Manufacturing plant. When this plant is operating, acid wastes from the manufacture of nitric and sulfuric acids are discharged to the Jenny Lind Flume in addition to organic wastes from the nitrocellulose line. These organic wastes include nitrocellulose, ether, alcohol, butylthalate, diphenyl, and a few others.

Three sources of domestic waste discharge from the site total approximately 350,000 gpd. Approximately 250,000 gpd of this waste is treated in a secondary treatment facility, chlorinated, and discharged to the Ohio River at Mile 593.4. Eighty thousand gpd are provided primary treatment, chlorinated, and discharged to a large reservoir which overflows via a small stream into the Ohio River at Mile 591.5. Secondary treatment facilities are now under contract. The remaining estimated 16,000 gpd is overflow from septic tanks serving 49 military housing units (160 persons). Overflow from these units is discharged directly to the Ohio River near Mile 592.8. Design funds and construction funds were requested in FY 71 and FY 72, respectively, for two new package aeration treatment plants.

A trip report prepared by the EPA, Region V, Federal Facilities Office, resulting from a plant visit on September 30, 1971, is contained in Appendix D. The report outlines in detail waste treatment facilities and practices, proposed improvements and makes recommendations for additional improvements.

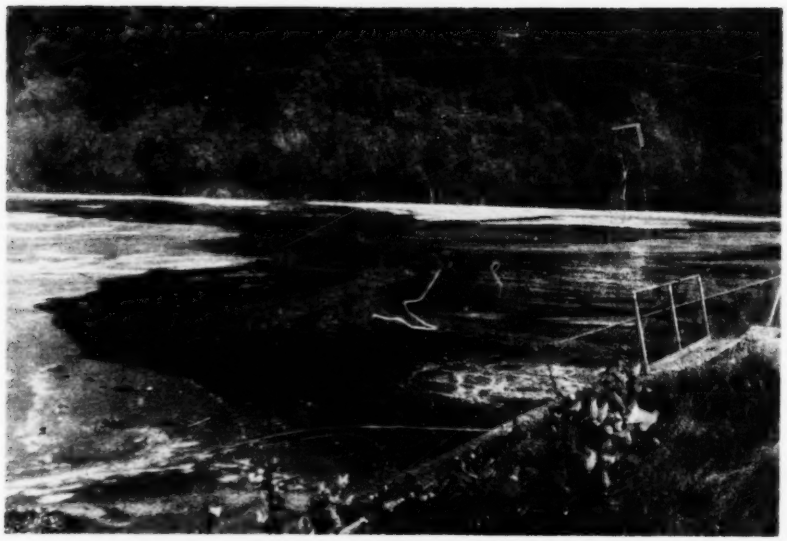
Indiana-Kentucky Electric Corporation, Madison, Indiana

The Clifty Creek power plant, located about one mile west of

Madison, Indiana, on the north bank of the Ohio River, produces approximately 31 million KWH of electricity per day.

No wastewater samples were collected during the recent survey; however, a visit to the plant was made. The main discharge is 960,000 gallons per minute of once-through cooling water that experiences a 11°F temperature rise through the system. Periodically (twice per day in summer), the cooling water system is chlorinated for a 30-minute duration for algae control, producing 0.35 ppm chlorine in the effluent during these periods. The company also has a fly ash pond with an average inflow of 6,800 gpm (Figure 11). Water in the lower end of this pond is very clear and appears to be extremely well settled. Two bottom ash ponds have inflows of 2,190 gpm and 1,100 gpm. The domestic waste from the 325 employees is treated in an extended aeration plant and chlorinated before discharge to the river.

FIGURE 11



Fly Ash Pond at the Indiana-Kentucky Power Corp. Clifty Creek Plant

Another View of the Fly Ash Pond Showing the Sediment Deposit to the far Background of the Picture

This section contains a discussion of physical, chemical, and microbiological data collected on the Ohio River and tributaries during the five-day study in September 1972. A complete tabulation of the data is contained in Appendix C.

FLOW

The Ohio River average daily flow at McAlpine Dam for 41 years of record is 110,700 cfs. Flows during the five-day survey from September 19-23 were 27,200; 28,100; 19,200; 33,200; and 44,600 cfs[1/] respectively. These flows, which averaged 30,460 cfs, are well below the average daily discharge for the year but about normal for expected September flows.

TEMPERATURE

Ohio River water temperatures ranged from 24°C to 27°C with a noticeable and consistent cooling of water temperatures occurring during the study. No significant temperature variations were observed below any waste discharges or in the lateral or vertical cross-sections of the river. No measurable temperature change was observed from above (Station 561.0) to below (Station 566.3) the Indiana-Kentucky Clifty Creek Power Plant. The power company discharges approximately 960,000 gpm of cooling water with an 11°F temperature rise which would amount to a calculated 0.42°F river

---

1/ Flow data supplied by the U. S. Army Corps of Engineers, Louisville, Kentucky.

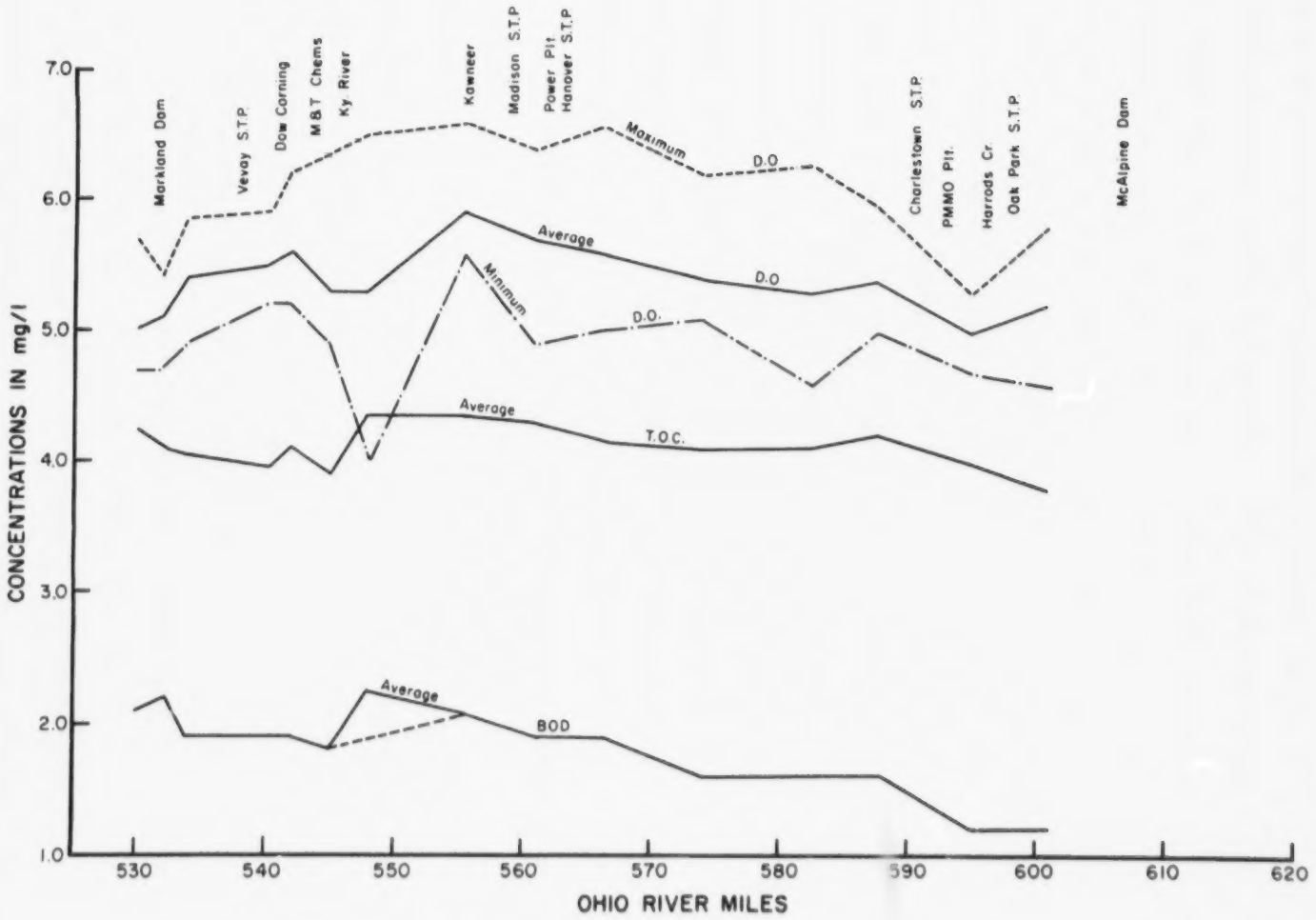
temperature increase based on a river flow of 30,000 cfs and fully mixed. No variation was observed during the survey since the dial thermometers used were sensitive only to $\pm$ 0.5°C. Temperatures in the Kentucky River ranged between 24°C and 26°C.

DISSOLVED OXYGEN

Dissolved oxygen (DO) concentrations in the study reach of the Ohio River ranged from 4.0 mg/1 to 6.6 mg/1. The lowest observed DO was 4.0 mg/1 recorded on September 19 at RM 547.9, downstream from the confluence of the Kentucky River, the three industrial waste sources in Carrollton, Kentucky, and the Carrollton sewage treatment plant effluent. Dissolved oxygen concentrations in the Kentucky River (Station K-1.4) upstream from the Carrollton STP effluent averaged 6.3 mg/1. Of the 176 DO observations taken from mid-channel in the Ohio River, 27 observations or 15.3 percent were below 5.0 mg/1. Of the 66 mid-channel observations at the five-foot depth, eight observations or 12.1 percent were less than 5.0 mg/1.

Minimum dissolved oxygen concentrations permitted by the Indiana and Kentucky water quality standards for "aquatic life" are 4 mg/1 with a daily average of not less than 5 mg/1. No instantaneous DO concentrations less than 4.0 mg/1 were observed in the study reach. Although daily averages were not determined (daily grab samples were taken at each station), a probability of violation is suggested at most of the nine stations where individual grab samples of less than 5.0 mg/1 were observed (minimum DO values plotted on Figure 12).

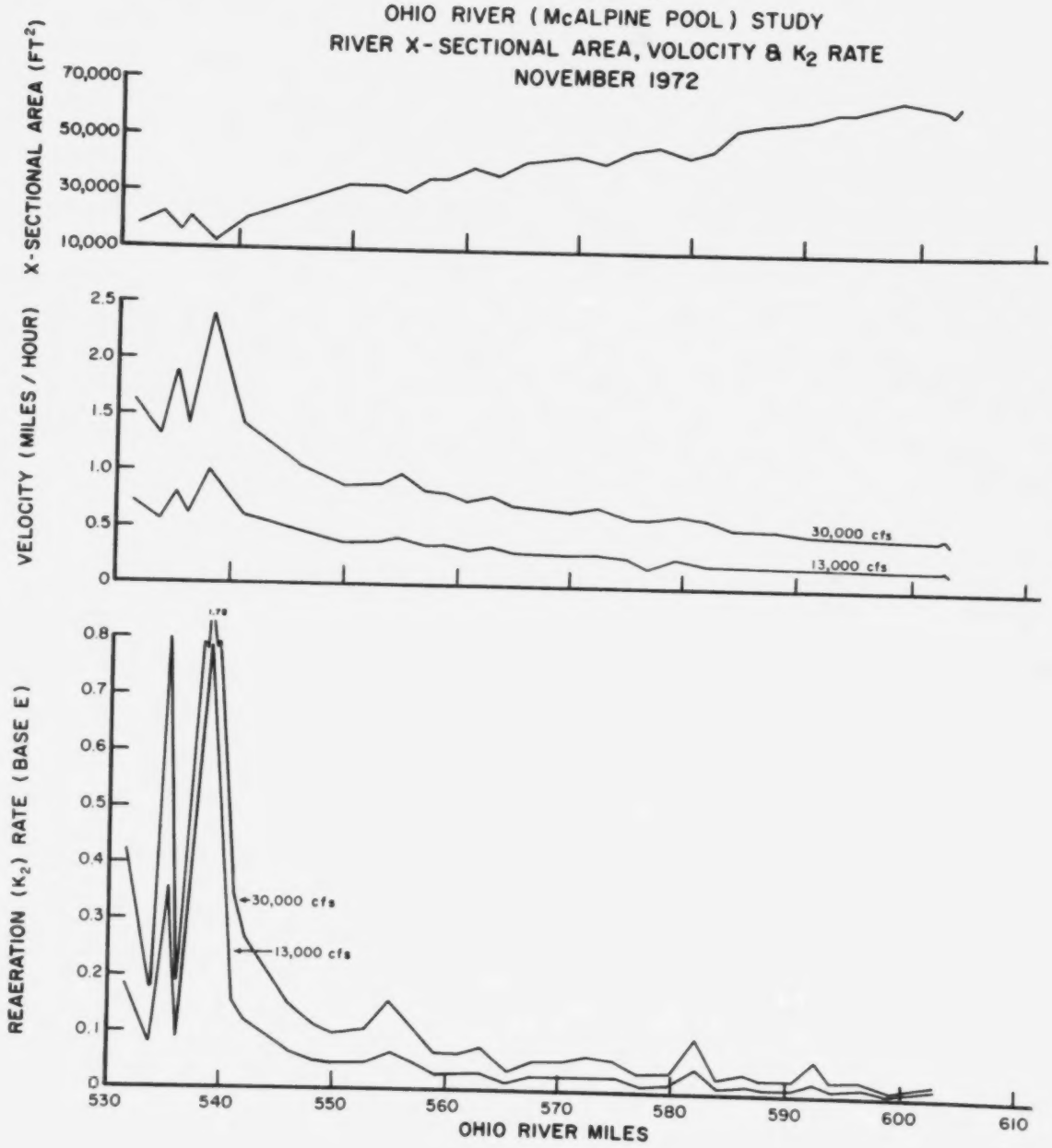
FIGURE 12
OHIO RIVER (McALPINE POOL) STUDY
DO, TOC, & BOD_5 CONCENTRATIONS
NOVEMBER 1972



Slight vertical and horizontal stratification was observed within the study reach. Vertically, oxygen concentrations at the five-foot depth generally averaged 0.1 to 0.2 mg/l higher than concentrations one foot from the bottom; however, at Station 600.6, the DO observations at the five-foot and one-foot above the bottom levels averaged exactly the same. Horizontal stratification was present from Markland Dam down to the Carrollton area, where DO concentrations were higher on the Kentucky side. These higher values probably resulted because releases from the tainter gates and locks at Markland Dam receive different amounts of reaeration than water passing through the generators. Variations in concentrations up to 1.1 mg/l were observed at Station 533.8 between the quarter points. Data collected at Station 530.0 did not show this variation; however, the water containing higher dissolved oxygen probably passed between the quarter point and the Kentucky shore.

Oxygen levels entering the McAlpine Pool from Markland Dam were depressed, averaging 5.0 mg/l. The level increased downstream for the next 25 miles due to atmospheric reaeration. After reaching an average concentration of 5.9 mg/l, the DO levels fall off steadily downstream to McAlpine Dam. Oxygen levels in the Kentucky River above the Carrollton waste discharge averaged 6.1 mg/l, which is 0.7 mg/l higher than the Ohio River immediately above the confluence. Due to the high dilution ratio, no increase in DO was observed below the confluence. Figure 13 presents a graphical plot of changing river cross-sectional area, calculated velocities and reaeration

FIGURE 13
OHIO RIVER (McALPINE POOL) STUDY
RIVER X-SECTIONAL AREA, VOLOCITY & K_2 RATE
NOVEMBER 1972



coefficients. Cross-sections were furnished by the U. S. Army Corps of Engineers. Velocities were calculated as average velocities through the cross-sectional area (i.e., V=Q/A) and reaeration rates were calculated using the Churchill Method.(3) The cross-sectional area of McAlpine Pool increases from approximately 20,000 ft^2 below Markland Dam to 60,000 ft^2 near McAlpine Dam. The velocity and reaeration rate vary inversely with area as shown in Figure 14. The high reaeration rate in the upper 20 miles of the study reach corresponds very closely to the break in the DO profile. Thus, in the upper reach of McAlpine Pool, the atmospheric reaeration rate exceeds the oxygen uptake and, as the velocity decreases with increasing cross-sectional area downstream, a decrease of reaeration rate takes place. Average time of travel through the reservoir was calculated using the cross sectional areas and river flow rates of 30,000 cfs and 13,000 cfs. The resulting times were 5.98 days at a flow rate of 30,000 cfs and 13.80 days at a rate of 13,000 cfs.

BIOCHEMICAL OXYGEN DEMAND

A plot of average BOD_5 values show a gradual decrease in concentration as the river flows through the study reach (Figure 12). The high BOD_5 near Markland Dam (2.2 mg/l average) and the general decline in concentration through the study reach to an average of 1.2 mg/l at the Louisville water intake indicates that the stream is recovering from upstream (Cincinnati area) waste loads. Observed values ranged from 3.7 mg/l recorded on September 22 at Station 0-547.9 to a low of 0.9 mg/l at Station 0-574.0 on September 23.

The 3.7 mg/l concentration could reasonably be omitted since it is nearly double the quarter point readings taken at the same time as well as all other observations in the study reach. If this value is omitted, the average BOD_5 plot will appear as the dotted line in Figure 13 and the maximum value observed at this station is 2.2 mg/l. BOD_5 levels at Station K-1.4 (Kentucky River) averaged 1.5 mg/l. This compares to 1.8 mg/l in the Ohio River immediately above the confluence.

Table V contains a listing of the major dischargers to McAlpine Pool, their BOD_5 loadings and relative contribution as a percentage of the total waste load. Discharges from the Madison, Indiana STP and the M & T Chemicals Plant in Carrollton, Kentucky, account for over 75 percent of the measured BOD_5 discharged into the river.

It is practically impossible to measure the singular effects of any one of the relatively small BOD_5 loads on the river. BOD_5 waste load discharged into the study reach are insignificant in comparison with discharges to other reaches of the Ohio River such as the Cincinnati and Louisville areas. The combined waste load of 7,350 pounds per day (population equivalent = 43,200) cannot have a very substantial effect upon the Ohio River at the flow rates encountered during the study. These loads, although small, do retard recovery of the river which, in this reach, is recovering from the Cincinnati area waste load.

TOTAL ORGANIC CARBON

All TOC concentrations for Ohio River stations fell within the

TABLE V

BOD_5 LOADING (LBS/DAY) TO McALPINE POOL
OHIO RIVER (McALPINE POOL) STUDY

SEPTEMBER 1972

Discharger	Lbs/Day	Percent of Total
Madison, IN, STP	3,140	42.7
M&T Chemicals, Carrollton, KY	2,370	32.2
Charleston, IN, STP	567	7.7
Carrollton, KY, STP	468	6.4
Oak Park Conservancy District, IN, STP	328	4.5
Dow Corning, Carrollton, KY	178	2.4
Louisville Hite Creek STP	159	2.2
Hanover, IN, STP	78	1.1
Indiana Army Ammunition Plant	35*	0.5
Kawneer, Inc., Carrollton, KY	13	0.2
Vevay, IN, STP	5	0.1
	7,341	100.0

* Estimate based on information contained in Appendix D

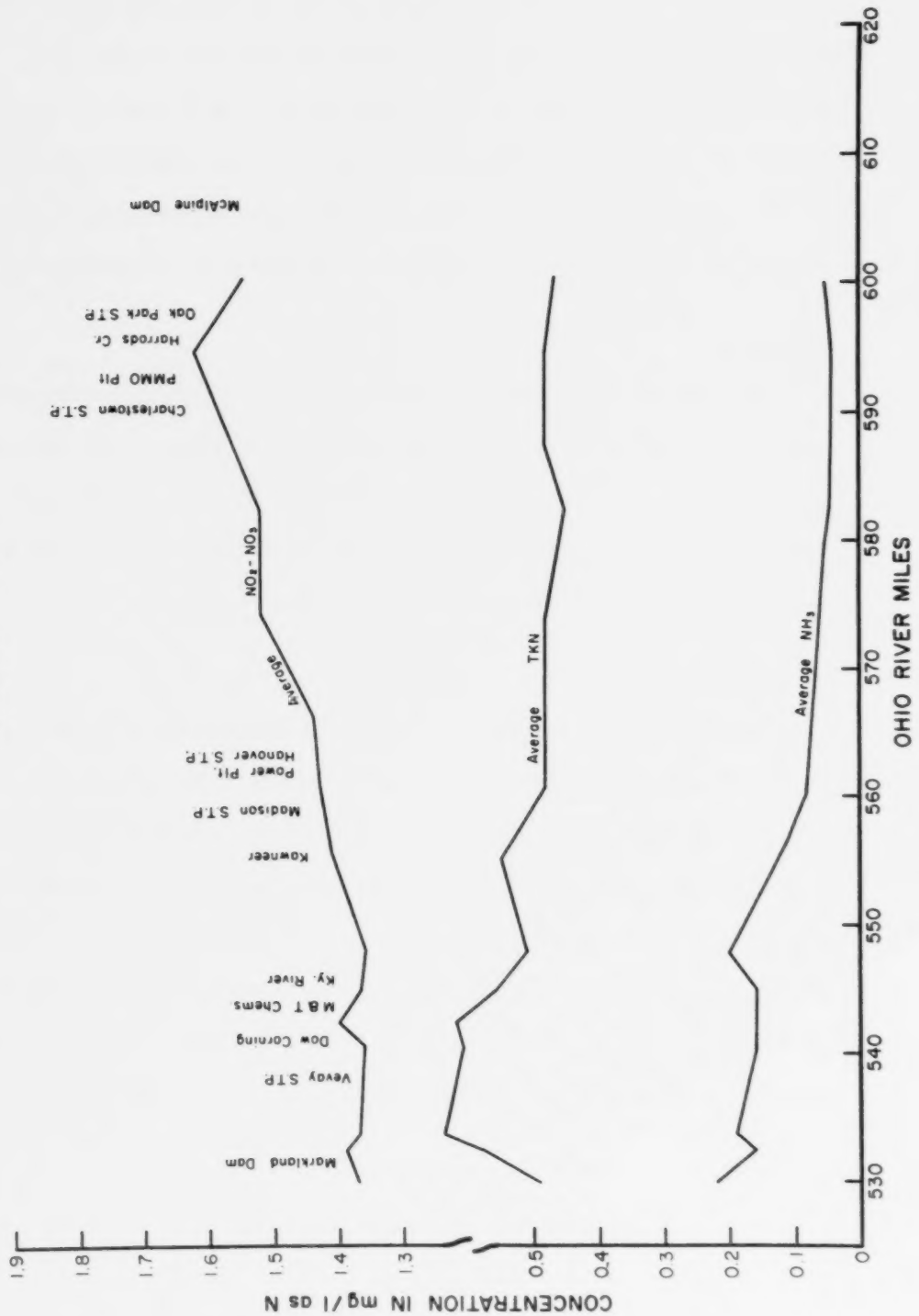
2.8 to 6.3 mg/l range. Figure 12 presents a profile of average observed concentrations. As would be expected, the TOC profile and BOD_5 profile are similar. In both cases, there is a slight increase in concentration downstream from the confluence of the Kentucky River. The two largest sources of TOC discharge in this immediate area are M & T Chemicals (1,065 lbs/day) and the Carrollton sewage treatment plant (243 lbs/day). The average TOC concentration of the Kentucky River upstream from the Carrollton STP discharge averaged 4.4 mg/l or essentially the same as the Ohio River concentrations.

NITROGEN

Total nitrogen concentrations averaged about 2.0 mg/l for Ohio River stations. Nitrification was actively underway as evidenced by the reduced ammonia level from 0.2 mg/l at the head of the reach to 0.05 mg/l near the lower end with a corresponding increase in the nitrite-nitrate concentration (Figure 14). The nitrogen contribution from individual waste sources and tributary streams within the study reach had no measurable effect on nitrogen concentrations in the river. The Kentucky River station (K-1.4) had an average total nitrogen concentration of 0.84 mg/l-N.

A comparison of Figures 12 and 14 shows that the change in ammonia concentrations is very similar to the change in BOD_5 concentrations and inversely proportional to the nitrite-nitrate concentrations. Thus, ammonia is oxidized to nitrate (nitrification) within the reach with a corresponding uptake of oxygen. In fact, it appears that most of the oxygen demand is due to oxidation of ammonia.

FIGURE 14
OHIO RIVER (McALPINE POOL) STUDY
AVERAGE NITROGEN CONCENTRATIONS
NOVEMBER 1972



It has been shown that approximately 4.6 mg of oxygen are required to oxidize 1 mg of ammonia to the nitrate form.(6) A 0.16 mg/l reduction of ammonia was observed through the study reach, which accounts for a theoretical oxygen uptake of 0.16 X 4.6 = 0.74 mg/l. Therefore, considering the reservoir as a steady state with a five-day flow through time, calculations show that approximately 0.74 mg/l of the measured 0.9 mg/l of BOD_5 can be attributed to nitrification.

PHOSPHORUS

Phosphorus concentrations were essentially constant throughout the study reach (Figure 15). The maximum Ohio River total phosphorus concentration was 0.13 mg/l and the minimum value was 0.08 mg/l. Approximately 93 percent of the phosphorus was dissolved. The average concentration in the Kentucky River was 0.09 mg/l.

pH AND ALKALINITY

All pH values were in the 7.0 to 7.5 range, which is well within the limits established by the state standards. The Indiana standards specify 6.0 to 9.0 for the aquatic life classification. Average alkalinities for the Ohio River stations ranged from 52 to 60 mg/l with no significant trend. Alkalinity values for the station near the mouth of the Kentucky River were slightly higher at 94 mg/l. The pH values were also higher at 7.5. This is probably due to extensive exposed limestone formations in the Kentucky River Valley.

SPECIFIC CONDUCTANCE

Specific conductance averaged between 401 and 431 µmhos/cm for all Ohio River stations. Values decreased slightly through the reach, being highest near Markland Dam.

Both the Indiana and Kentucky water quality standards require that dissolved solids not exceed 500 mg/l as a monthly average value nor exceed 750 mg/l at any time for Ohio River public water supply use classifications. In lieu of actual dissolved solids measurements, both states permit the use of specific conductance data[1/] where 800 and 1,200 µmhos/cm are equivalent to dissolved solids concentrations of 500 mg/l and 750 mg/l, respectively. Dissolved solids (specific conductance) limitations for public water supply use were not exceeded during the study.

TURBIDITY

Turbidities ranged from 3 to 15 Jackson Turbidity Units (JTU) with average values at Ohio River stations ranging between 4 and 10. As would be expected, there was a gradual reduction in turbidity through the McAlpine Pool.

BACTERIOLOGICAL

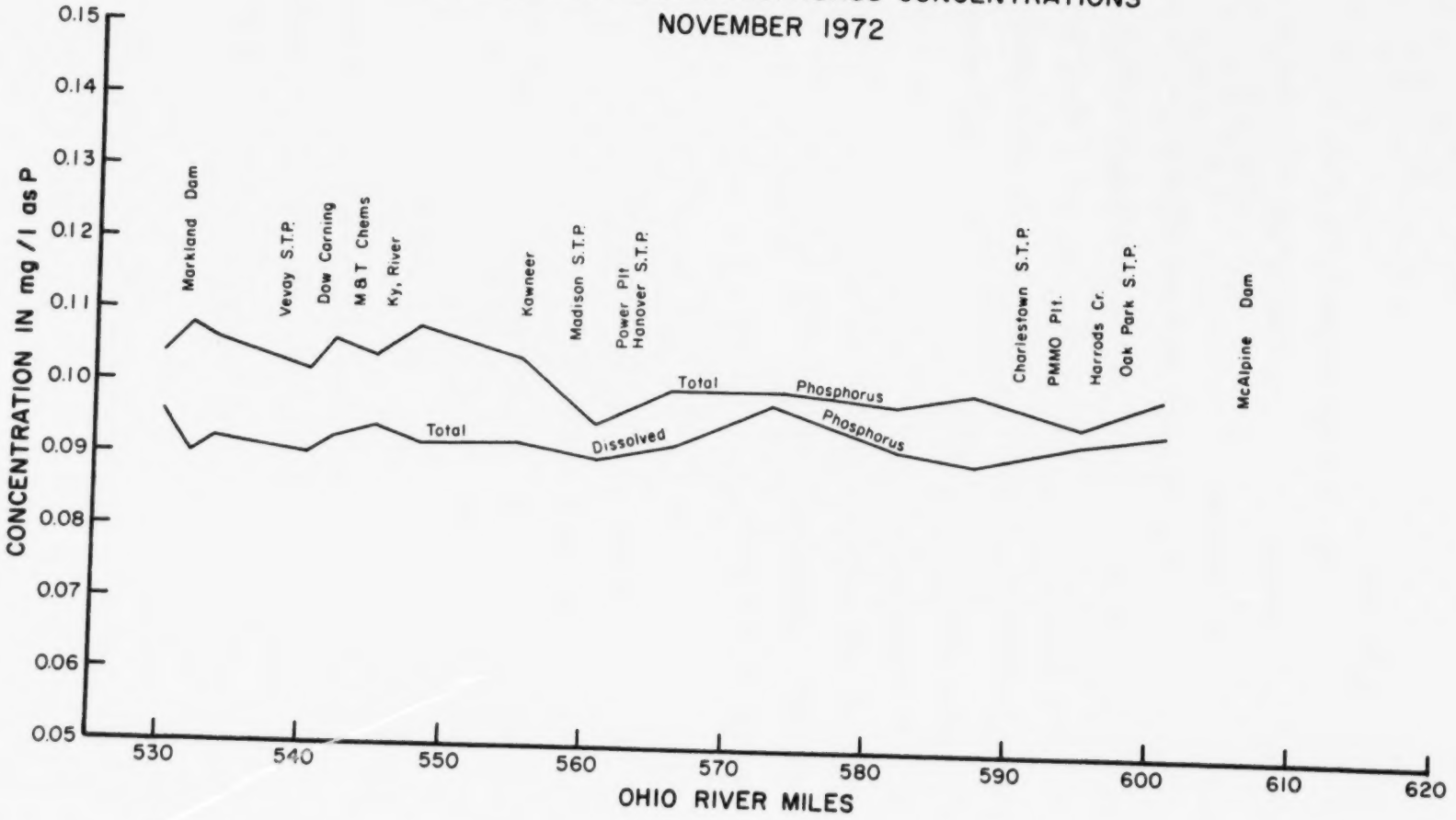
The background station in the study reach was located upstream from Markland Dam at River Mile (RM) 530.0 (Figure 1). The bacterial quality of the river at this point was characterized by mean[2/] total

---

1/ Values referenced to 25°C.

2/ All means are geometric means.

FIGURE 15
OHIO RIVER (McALPINE POOL) STUDY
TOTAL & DISSOLVED PHOSPHORUS CONCENTRATIONS
NOVEMBER 1972



and fecal coliform densities of 980 and 82/100 ml, respectively (Table VI)

Downstream from Station 530.0, the first significant source of bacterial contamination enters the river from the Carrollton, Kentucky sewage treatment plant (Municipal Station CK — Table VII), discharging an average of 0.28 mgd to the Kentucky River near the mouth. The mean effluent total and fecal coliform densities were 81,000,000 and 18,000,000/100 ml, respectively. The effect of the Carrollton STP discharge on the river was seen in quarter point samples at RM 547.9, which showed slightly higher mean total and fecal coliform densities of 3,500 and 200/100 ml (Table VI, Figures 16 and 17). Total and fecal coliform densities in the Kentucky River upstream from the Carrollton effluent were 52/100 ml and 14/100 ml, respectively.

Downstream from Carrollton, the next major waste source discharging to the river is the Madison, Indiana STP, which discharged an average of 1.75 mgd of wastes with mean total and fecal coliform densities of 25,000,000 and 340,000/100 ml, respectively (Table VII). The impact of this waste discharge was seen at RM 561.0 (Figures 16 and 17).

At RM 597.6, the Oak Park STP discharged to the river via a small tributary stream an average of 0.23 mgd of waste with mean total and fecal coliform densities of 17,000,000 and 850,000/100 ml. As shown in Figures 16 and 17, there was little effect on the bacterial quality of the river resulting from this discharge.

TABLE VI

SUMMARY OF BACTERIAL WATER QUALITY
OHIO RIVER-McALPINE POOL
(NOVEMBER 1972)

Station	Total Coliform				No. Samples	Fecal Coliform			
	Maximum	Minimum	Average	G. Mean		Maximum	Minimum	Average	G. Mean
0-530.0	2,600	420	1,200	980	5	110	58	85	83
0-532.3	1,400	460	810	740	4	140	58	91	86
0-533.8	4,900	340	1,600	980	5	140	46	84	78
0-540.4	4,100	340	1,200	730	5	110	26	76	65
0-542.0	2,800	310	1,300	960	5	98	34	69	64
0-545.0-25	2,700	360	1,300	900	4	77	36	60	57
0-545.0-50	2,700	540	1,300	1,100	5	120	26	69	57
0-545.0-75	3,000	440	1,400	990	4	80	18	51	42
K-1.4	160	8	52	28	5	44	2	14	8
0-547.9-25	9,500	740	4,900	3,500	4	540	80	260	200
0-547.9-50	6,400	870	2,400	1,800	5	210	40	95	81
0-547.9-75	2,500	580	1,300	1,100	4	70	16	45	39
0-555.6	3,400	1,200	2,200	2,000	5	150	120	140	140
0-561.0-25	19,000	4,300	12,000	9,000	2	2,600	300	1,500	880
0-561.0-50	27,000	2,500	9,900	6,300	4	2,100	180	710	410
0-561.0-75	22,000	6,800	14,000	12,000	2	1,300	440	870	760
0-566.3	6,900	3,300	4,800	4,600	4	720	190	470	420
0-574.0	5,000	600	2,000	1,300	4	350	40	160	120
0-582.7	5,700	320	3,000	1,400	4	170	28	99	69
0-587.7	700	250	430	400	4	94	12	42	31
0-595.0-25	150	150	--	--	1	20	20	--	--
0-595.0-50	1,100	400	680	620	3	74	8	40	28
0-595.0-75	160	160	--	--	1	20	20	--	--
H-1.6	28,000	200	7,500	1,400	4	1,400	10	380	84
0-600.6	1,100	270	--	490	4	96	22	--	47

TABLE VII

SUMMARY OF BACTERIAL WASTE SOURCE DATA
OHIO RIVER-McALPINE POOL
(NOVEMBER 1972)

Sta.	Total Coliform				No.	Fecal Coliform			
	Maximum	Minimum	Average	G. Mean	Samples	Maximum	Minimum	Average	G. Mean
CK	120,000,000	55,000,000	88,000,000	81,000,000	2	24,000,000	14,000,000	19,000,000	18,000,000
M&T	2,500	600	1,300	1,000	3	8	1	4	3
DC	8	<3	<5	<5	3	<4	<2	--	--
LK	4	4	--	--	1	2		--	--
KC	>1,600	>1,600	--	--	1	>800	>800	--	--
OP	27,000,000	12,000,000	18,000,000	17,000,000	3	1,900,000	360,000	1,100,000	850,000
HA	<1,000	<100	--	--	2	<100	<10	--	--
MA	86,000,000	7,300,000	47,000,000	25,000,000	2	3,300,000	35,000	1,700,000	340,000
VE	<1,000	<1,000	--	--	1	<100	<100	--	--

FIGURE 16

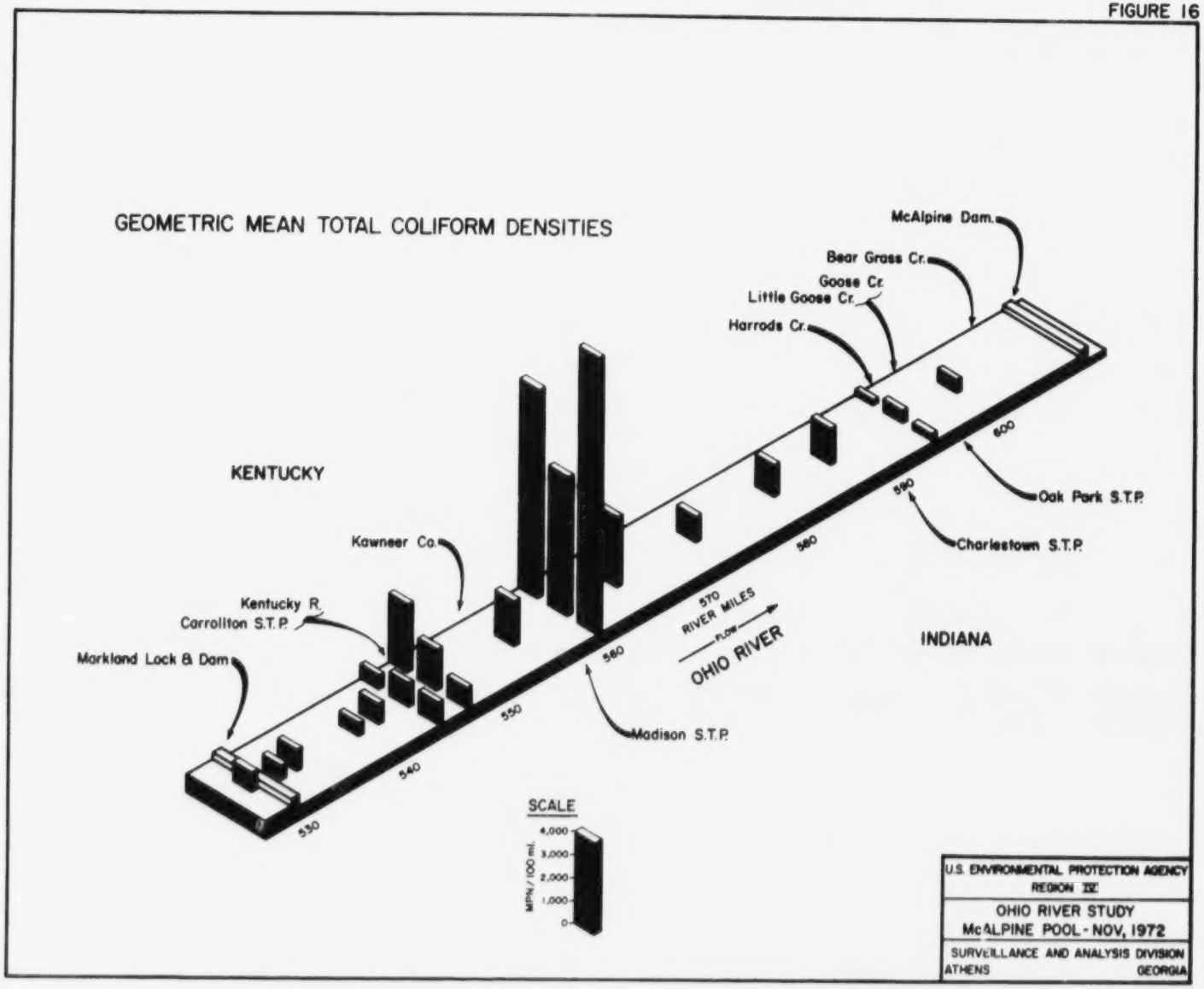
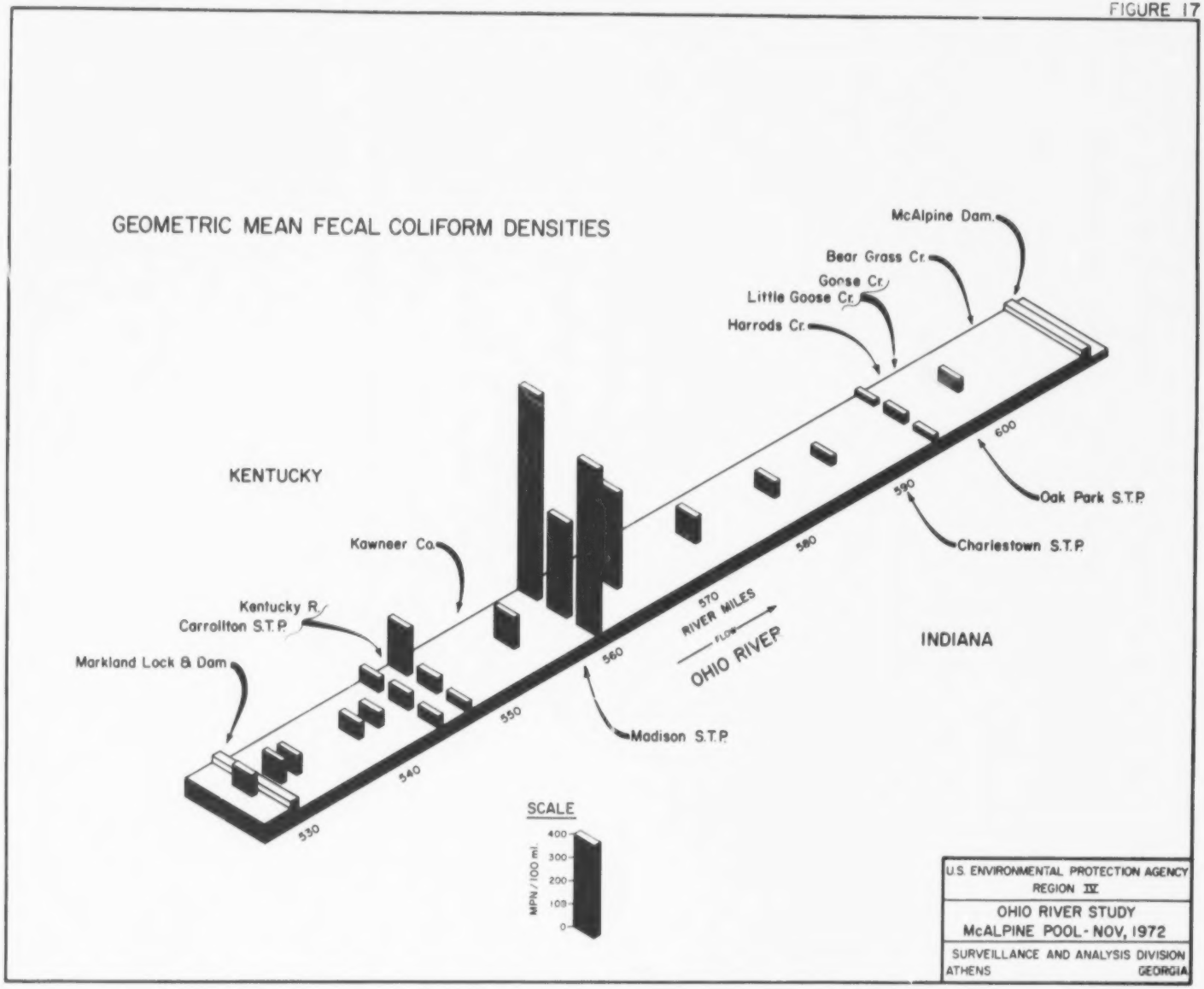

GEOMETRIC MEAN TOTAL COLIFORM DENSITIES
McAlpine Dam.
Bear Grass Cr.
Goose Cr.
Little Goose Cr.
Harrods Cr.
KENTUCKY
Kawneer Co.
Kentucky R.
Carrollton S.T.P.
Markland Lock & Dam
600
590
580
570
560
550
540
530
RIVER MILES
FLOW
OHIO RIVER
INDIANA
Oak Park S.T.P.
Charlestown S.T.P.
Madison S.T.P.
SCALE
MPN / 100 ml.
4,000
3,000
2,000
1,000
0
U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV
OHIO RIVER STUDY
McALPINE POOL - NOV, 1972
SURVEILLANCE AND ANALYSIS DIVISION
ATHENS GEORGIA

FIGURE 17


GEOMETRIC MEAN FECAL COLIFORM DENSITIES
McAlpine Dam
Bear Grass Cr.
Goose Cr.
Little Goose Cr.
Harrods Cr.
KENTUCKY
Kawneer Co.
Kentucky R.
Carrollton S.T.P.
Markland Lock & Dam
530
540
550
560
570
RIVER MILES
FLOW
OHIO RIVER
580
590
600
Oak Park S.T.P.
Charlestown S.T.P.
Madison S.T.P.
INDIANA
SCALE
MPN / 100 ml.
400
300
200
100
0
U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV
OHIO RIVER STUDY
McALPINE POOL - NOV, 1972
SURVEILLANCE AND ANALYSIS DIVISION
ATHENS GEORGIA

The bacterial quality of the river at the most downstream sampling site in the study reach at RM 600.6 was characterized by mean total and fecal coliform densities of 490 and 47/100 ml, respectively. The densities at this station were lower than those observed during a 1971 EPA investigation when the mean total and fecal coliform densities were 4,500 and 140/100 ml, respectively.

Salmonella swabs were retrieved from River Mile 530.0, 540.4, 547.9, and 561.0, but no Salmonella were isolated from these samples.

Applying the Kentucky water quality standards to the bacterial water quality observed during the September 1972 investigation, the following violations were noted:

- The total coliform portion of the Kentucky standard was violated between RM 545.0 and 582.7.
- The fecal coliform portion of the Kentucky standard was violated between RM 561.0 and 566.3.

The Indiana water quality standard for recreational waters was violated between RM 561.0 and 566.3. These violations result from the high coliform discharges from the Carrollton, Kentucky, and Madison, Indiana, sewage treatment plants.

REFERENCES

1. J. E. McKee and H. W. Wolf, Water Quality Criteria, Second Edition (Revised 1963), California State Water Resources Control Board, Publication No. 3-A, Sacramento (1971).

2. R. Norris Shreve, Chemical Process Industries, Third Edition, Mc-Graw-Hill Book Company, 1967.

3. Tennessee Valley Authority, "The Prediction of Stream Reaeration Rates," Chattanooga, Tennessee, July 1962.

4. U. S. Department of Health, Education, and Welfare, Public Health Service, "Ohio River - Cincinnati Pool," Part I - 1957 Survey.

5. U. S. Department of Health, Education, and Welfare, Public Health Service, "Ohio River - Cincinnati Pool," Part II - 1960 Survey.

6. U. S. Department of Health, Education, and Welfare, Public Health Service, "Oxygen Relationships in Streams," Robert A. Taft Sanitary Engineering Center, Cincinnati, 26, Ohio, March 1958.

APPENDIX A

STATION LOCATIONS AND STUDY PLAN

OHIO RIVER-McALPINE POOL

OHIO RIVER (McALPINE POOL) STUDY
STATION LOCATIONS

Industrial

DC — The effluent from Dow Corning Corporation of Carrollton, Kentucky. Samples were collected from a manhole in the effluent discharge pipe between the Company parking lot and Hwy. 42. The discharge flows into the Ohio River near R.M. 541.0.

M&T — The effluent from M&T Chemicals, Inc. of Carrollton, Kentucky. Samples were collected from the waste discharge pipe on the bank of the Ohio River. The waste flows into the river near R.M. 543.5.

KC — The effluent from Kawneer Co., Inc. of Carrollton, Kentucky. Samples were collected from the waste sump inside the plant. The waste flows into the river near R.M. 554.7.

Municipal

CK — The effluent from the Carrollton, Kentucky, primary sewage treatment plant. The waste flows into the Kentucky River at mile 0.7.

LK — The effluent from the Louisville Jefferson County Sewer District's Hite Creek tertiary sewage treatment plant. This waste flows into Hite Creek tributary to Herrods Creek tributary to the Ohio River near mile 595.9.

OP* — Effluent from the Oak Park Conservency District's primary sewage treatment plant. The waste flows into a small stream which flows into the Ohio River near mile 597.6.

CH* — Effluent from Charlestown, Indiana, primary sewage treatment plant. The waste is piped to the Ohio River near R.M. 590.5.

HA* — Effluent from the Hanover, Indiana, secondary sewage treatment plant. The waste is piped to the Ohio River near R.M. 562.6.

MA* — Effluent from the Madison, Indiana, primary sewage treatment plant. The effluent is piped to the Ohio River at R.M. 558.8.

VE* — Effluent from the Vevay secondary sewage treatment plant. The waste flows into the Ohio River near R.M. 538.

Stream

0-530.0 — Ohio River 1.5 miles upstream of Markland Lock and Dam.

0-532.3 — Ohio River 0.8 mile downstream of Markland Lock and Dam.

0-533.8 Ohio River 1.0 mile downstream of Markland Lock and Dam and adjacent to Lindenburn day mark.

0-540-4 Ohio River 0.6 mile upstream of Dow Corning waste outfall and adjacent to Minnet run light.

0-542.0 Ohio River upstream of M&T Chemicals and downstream of Dow Corning waste outfalls.

0-545.0 Ohio River 1.5 miles downstream of M&T Chemicals outfall.

0-547.9 Ohio River 2.2 miles below confluence with the Kentucky River adjacent to Notch Lick light.

0-555.6 Ohio River 2.2 miles upstream of Madison, Indiana, STP effluent and 0.9 mile downstream of Kawneer Company outfall. Adjacent to the Richwood light.

0-561.0 Ohio River 3 miles downstream of the Madison, Indiana, STP effluent and adjacent to the Clifty Creek light.

0-566.3 Ohio River downstream of Hanover STP and Clifty Creek Power Company effluents and adjacent to Spring Creek light.

0-574.0 Ohio River adjacent to Bethlehem Reach light.

0-582.7 Ohio River adjacent to Oldham County's water district municipal intake.

0-587.7 Ohio River 1.7 miles upstream of Fourteen Mile Creek.

0-595.0 Ohio River below outfalls from the Indiana Army Ammunition Plant and above the confluence of Harrods Creek.

0-600.6 Ohio River adjacent to the Louisville, Kentucky, municipal water intake.

K-1.4 Kentucky River upstream of the Carrollton, Kentucky, STP effluent and 1.4 miles above the confluence of the Ohio River.

H-1.6 Harrods Creek at U.S. Hwy. # 42 bridge 1.6 miles above the mouth.

* Samples analyzed by EPA, Evansville, Indiana, office.

Note: Ohio River mileage and station location descriptions are based on the Ohio River Navigation Charts produced by the U.S. Army Crops of Engineers.

STUDY PLAN
OHIO RIVER-MCALPINE POOL

OBJECTIVES

- To determine the cause of low dissolved oxygen concentrations observed in the lower portion of McAlpine Pool during the August-September 1971 EPA, Region IV, Ohio River Study.
- To characterize the industrial and municipal waste discharges into the study reach of the Ohio River.

SCOPE

The study area will be limited to the reach of Ohio River between Louisville, Kentucky (RM 600), and Markland Pool adjacent to Craigs Creek at RM 530.

AUTHORITY

Authority for the study is granted in the Federal Water Pollution Control Act as amended. The work will be performed under the direction and supervision of the Environmental Protection Agency, Surveillance and Analysis Division, Athens, Georgia.

TIME SCHEDULE

- Field study - September 18-25, 1972
- Complete lab analysis - October 31, 1972
- Finished report - November 30, 1972

GENERAL FIELD ACTIVITIES

The principal effort in this study will be directed toward the collection of stream quality data. The relatively few sources of

municipal and industrial waste discharged into the study reach will be sampled to determine possible effects upon Ohio River water quality.

The Louisville-Jefferson County Metropolitan District will provide laboratory space for the study at the Fort Southworth sewage treatment plant. Samples will be collected, packed in ice, and delivered to the Fort Southworth lab for a portion of the required analysis. The samples will be forwarded to the Environmental Protection Agency lab in Athens, Georgia, for completion of the analysis.

WATER QUALITY STUDIES

Samples will be collected for five consecutive days at the 17 stream sampling stations listed in Table 1. Field analysis will consist of:

- DO (Field titration)
- pH (Field meter)
- Temperature

Other chemical analyses:

- BOD_5
- Turbidity
- Acidity and Alkalinity
- Nitrogen series (NH_3, NO_2-NO_3, TKN)
- Phosphorus - Total and Soluble
- Specific Conductance

Bacteriological analyses:

- Total and Fecal Coliform
- Salmonella Isolation

TABLE 1

OHIO RIVER (MCALPINE POOL) STUDY
STATION LOCATIONS AND SAMPLE ANALYSIS

Sta No & Ohio RM	Station Description	Chemical Analysis	Bacti	Field Analysis	Sampling Point	# of Complete Chemistry Samples
0-530.0	Ohio Riv 1.5 mi. upstream of Markland Lock & Dam	C	C (S)	G	OP	1
0-532.3	Ohio Riv 0.8 mi. downstream of Markland Lock & Dam	C	C	G	OP	1
0-533.8	Ohio Riv adjacent to Lindenburn Daymark, 1 mi. downstream of Markland Lock & Dam	C	C	G	OP	1
0-540.4	Ohio Riv adjacent to Minnet Run light, 0.6 mi. upstream of Dow Corning outfall	C	C (S)	G	OP	1
0-542.0	Ohio Riv upstream of M&T Chemicals outfall but downstream of Dow Corning outfall	G	G		CC	1
0-545.0	Ohio Riv 1.5 mi downstream of M&T Chemicals outfall	G	G		OP	3
K-1.0 (Approx.)	Kentucky Riv upstream of primary STP outfall of Carrolton, KY & upstream of backwater effects of Ohio Riv	G	G		CC	1
0-547.9	Ohio Riv adjacent to Notch Lick light, 2.2 mi. downstream of Kentucky Riv	G	G (S)		OP	3
0-555.6	Ohio Riv adjacent to Richwood light, 2.2 mi. upstream of Madison, IN & 0.9 mi downstream of Kawneer Co. outfall	C	C	G	QP	1
0-561.0	Ohio Riv adjacent to Clifty Creek light, 3 mi. downstream of Madison, IN	G	G (S)		OP	3

ABLE 1 (Contd)

Sta No & Ohio RM	Station Description	Chemical Analysis	Bacti	Field Analysis	Sampling Point	# of Complete Chemistry Samples
0-566.3	Ohio Riv adjacent to Spring Creek light, downstream of Hanover, IN sec. STP & Clifty Creek Power Co., fly ash pond eff.	G	G (S)		CC	1
0-574.0	Ohio Riv adjacent to Bethlehem Reach light	G	G		CC	1
0-582.7	Ohio Riv adjacent to Oldham Co. water district municipal intake, downstream of Westport, KY and Bethlehem, IN	C	C	G	QP	1
0-587.7	Ohio Riv 1.7 mi. upstream of Fourteen Mile Creek	G	G (S)		CC	1
0-595.0 (Approx.)	Ohio Riv upstream of Harrods Creek but downstream of Possible Lagoon outfall & waste from Indiana Army Ammo Plant	G	G (S)		QP	3
H-0.8	Harrods Creek at River Road Bridge, 0.8 mi. upstream of mouth of creek	G	G		CC	1
0-600.6	Ohio Riv adjacent to Louisville, KY municipal water intake, 6.2 mi. upstream of McAlpine Lock & Dam	C	C (S)	G	QP	1
					TOTAL -	25

C = Quarter point composite-chemistry samples composited on-site; bacteriology samples composited in field lab.
G = Grab.
(S) = Salmonella swab.
QP = Quarter points identified looking downstream, left quarter (25%), center channel (50%), right quarter (75%).
CC = Center channel

Samples will be collected at the following depths:

- Field Analysis (DO, pH, Temperature)
  1) Stream depth <10 feet mid depth.
  2) Stream depth 10 to 15 feet - 5 feet from surface
     - 1 foot from bottom
  3) Stream depth >15 feet - 5 feet from surface
     - mid depth
     - 1 foot from bottom
- Chemical Analysis - mid depth in stream <10 feet deep and at 5 feet in stream $\geq$ 10 feet deep.
- Bacteriological - immediately below surface (approximately 1 foot).

MUNICIPAL WASTE

Samples will be collected at the nine waste treatment facilities listed in Table 2. Composite samples will be collected proportional to flow where possible. Grab samples will be collected from the septic tank overflow. The following analyses will be made:

- Flow (field measurement or plant equipment)
- pH (field meter)
- BOD_5
- TOC
- Total Solids
- Nitrogen Series (TKN, NH_3, NO_2-NO_3)
- Total Phosphorus

TABLE 2
OHIO RIVER (MCALPINE POOL) STUDY
DOMESTIC WASTE TREATMENT PLANTS

Ohio RM	Municipality	Treatment	Sampling Point	Sampling Period
545.8*	Carrollton, Kentucky	Primary + Cl_2	Effluent	One 24-Hr Composite
558.8	Madison, Indiana	Primary + Cl_2	Effluent	One 24-Hr Composites
562.6	Hanover, Indiana	Secondary + Cl_2	Effluent	One 24-Hr Composite
590.5	Charlestown, Indiana	Primary + Cl_2	Effluent	One 24-Hr Composite
591.5	Indiana Army Ammunition Plant	Primary + Cl_2	Effluent	One 24-Hr Composite
592.8	Indiana Army Ammunition Plant	Septic Tank	Effluent	One Grab
593.4	Indiana Army Ammunition Plant	Secondary + Cl_2	Effluent	One 24-Hr Composite
595.9**	Louisville, Kentucky	Tertiary	Effluent	One 24-Hr Composite
597.6	Oak Park Conservency District	Primary + Cl_2	Effluent	One 24-Hr Composite

* Discharge is to the Kentucky River at Mile 0.7.
** Discharge is to a tributary of Harrods Creek.

- Total Suspended Solids
- Volatile Suspended Solids

Samples will be collected prior to chlorination with the exception of bacteriological samples which will be collected after the chlorine contact chamber where possible.

INDUSTRIAL WASTES

Two 24-hour composite samples will be collected on the industrial waste discharges listed in Table 3. Flow rates will be determined by:

- Company flow measuring equipment
- Flow measurement by EPA personnel
- Company water records
- Company estimate

One grab sample for coliform analysis will be collected at each effluent. Standard analyses will be:

- Temperature (beginning and end of composite)
- pH (beginning and end of composite)
- Alkalinity and Acidity
- BOD_5
- COD
- TOC
- Nitrogen Series (TKN, NO_2-NO_3, NH_3)
- Total Phosphorus
- Total Solids
- Suspended Solids

TABLE 3
OHIO RIVER (MCALPINE POOL) STUDY
INDUSTRIAL WASTE DISCHARGES

Ohio RM	Industry	Product	Waste Treatment		Sampling Points	Approx. Volume Incl Waste (MGD)	Sampling Period
			Domestic	Industrial			
541.0	Dow Corning Corp.	Silicons	?	Lagoons, Coagulation Vacuum Filtration	Effluent	5.0	Two 24-Hr Composites
543.5	M&T Chemicals, Inc.	Organic Tin Chemicals	Carrollton System	Lagoons	Effluent	4.8	Two 24-Hr Composites
554.7	Kawneer Co., Inc.	Annodized Al. Appliance Trim	?	?	Effluent	0.45	Two 24-Hr Composites
556.5*	Indiana Army Ammunition Plant	Manufature of Propellants & Loading of Cannon & Mortar Propellants	--	Settling	Laundry Waste Effluent	?	One 24-Hr Composite

* Discharge is to Lentzier Creek

These additional analyses may be required on industrial samples:

- Metals -- chromium, tin, copper, zinc, lead
- Organics
- Oil and grease
- Phenols
- Cyanide
- Detergent

APPENDIX A

PERSONNEL ROSTER AND TIME SCHEDULE
OHIO RIVER (MCALPINE POOL) STUDY

Study Director - David W. Hill

Personnel

Project Engineer----------Charles Sweatt

Microbiologist----------Herbert Barden

Chemist----------Tom Bennett

Chemist Aide----------Tom Sack

Aide----------Wayne Bentley

Field Personnel----------Rod Davis
Hugh Vick
Ray Wilkerson
Eddie Shollenberger

TENTATIVE TIME SCHEDULE

Date	Daily Activity	No. Samples Chem	No. Samples Bacti
9/18	• Drive from Athens to Louisville	--	--
9/19	• Make boat run upstream	25	17
	• Set up automatic samplers at:		
	1) Ammunition Plant Primary	--	--
	2) Ammunition Plant Secondary	--	--
	3) Ammunition Plant Laundry Waste	--	--
	Ammunition Plant Septic Tank (Grab)	1	1
		26	18
9/20	• Make boat run downstream	25	17
	• Collect composite samples	3	3
	• Set up automatic samplers at:		
	1) Oak Park Primary	--	--
	2) Charlestown Primary	--	--
	3) Hanover Secondary	--	--
		28	20
9/21	• Make boat run downstream	25	17
	• Collect composite samples	3	3
	• Set up automatic samplers at:		
	1) Dow Corning Corporation	--	--
	2) M&T Chemicals, Inc.	--	--
	3) Kawneer Company, Inc.	--	--
		28	20
9/22	• Make boat run upstream	25	17
	• Collect composite samples	3	3
		28	20
9/23	• Make boat run upstream	25	17
	• Collect composite samples	3	3
	• Set up automatic samplers at:		
	1) Madison Primary	--	--
	2) Carrollton Primary	--	--
	3) Louisville Tertiary	--	--
		28	20
9/24	• Collect composite samples	3	3
	• Collect any missed or lost samples; collect samples on Bear Grass and Goose Creeks if time permits	<6	<6
		<9	<9

APPENDIX B

CHEMICAL AND BACTERIOLOGICAL METHODS

Methods of Chemical Analyses
Water and Wastewater

Parameter	Sample Type	Method	Reference	Modification
Acidity	Water and Wastewater	Volumetric, NaOH Titration	1	None
Alkalinity	Water and Wastewater	Volumetric, H_2SO_4 Titration	1	None
Ammonia	Water and Wastewater	Automated Phenolate Method	2	None
Biochemical Oxygen Demand	Water and Wastewater	Winkler D.O.	1, 2	None
Chemical Oxygen Demand	Wastewater	Acid-Dichromate Oxidation	2	None
Chromium, Total	Wastewater	Atomic Absorption	1, 2	$HCl-HNO_3$ Digestion
Conductance, Specific	Wastewater	Wheatstone Bridge	1, 2	None
Copper	Wastewater	Atomic Absorption	1, 2	$HCl-HNO_3$ Digestion
Dissolved Oxygen	Water and Wastewater	Winkler Method	2	Azide
Lead	Wastewater	Atomic Absorption	1, 2	$HCl-HNO_3$ Digestion
Nitrate-Nitrite	Water and Wastewater	Automated (Cadmium Reduction)	2	None
pH	Water and Wastewater	Electrometric	1	None
Phosphorus, Soluable	Water and Wastewater	Automated (Single-Reagent)	2	None
Phosphorus, Total	Water and Wastewater	Automated (Single-Reagent)	2	None

Methods of Chemical Analyses
Water and Wastewater

Parameter	Sample Type	Method	Reference	Modification
Suspended Solids	Wastewater	Gravimetric	1	None
Tin	Wastewater	Atomic Absorption	1, 2	$HCl-HNO_3$ Digestion
Total Kjeldahl Nitrogen	Water and Wastewater	Automated Phenolate Method	2	None
Total Organic Carbon	Wastewater	Carbon Analyzer	2	None
Total Solids	Wastewater	Gravimetric, 105°C	1	None
Turbidity	Water	Hach Turbidimeter	2	None
Volatile Suspended Solids	Wastewater	Gravimetric, 550°C	1	None
Zinc	Wastewater	Atomic Absorption	1, 2	$HCl-HNO_3$ Digestion

References: 1. "Standard Methods for Examination of Water and Wastewater," 13th Edition, 1971

2. "EPA Manual of Methods for Chemical Analyses of Water and Wastes," 1971

Organic Analyses

Organics	Preparation	Extraction Solvent	Condictions	Detection
Organics	Neutral Extraction	15% Methylene Chloride in Hexane	GC	Flame Ionization*
Polar Organics	Acid Extraction	Methylene Chloride	Esterification, GC	Flame Ionization*
Water Soluable Organics	None	--	Direct Aqueous GC Injection	Flame Ionization

* The gas chromatograph/mass spectrometer system was used for identification when peaks were detected by flame ionization

BACTERIOLOGICAL METHODS

Total Coliform Enumeration: The membrane filter procedure outlined in Standard Methods (1) was used. The method employs M-Endo Broth with an incubation at 35 ± 0.5°C for 22-24 hours.

Fecal Coliform Enumeration: The membrane filter procedure outlined in Standard Methods (1) was used. The method employs M-FC Broth with an incubation temperature of 44.5 ± 0.2°C for 24 hours.

Salmonella Isolation and Identification: Swabs used for isolation purposes were placed into wide-mouthed jars containing approximately 200 ml of 1-1/2 strength Tetrathionate Broth with brilliant green added (1:100,000 w/v). The inoculated enrichment was incubated for 24-48 hours at 41.5°C according to the procedure of Spino (2). Some of the primary enrichments were subcultured again to Tetrathionate Broth with brilliant green for 18-24 hours at 41.5°C.

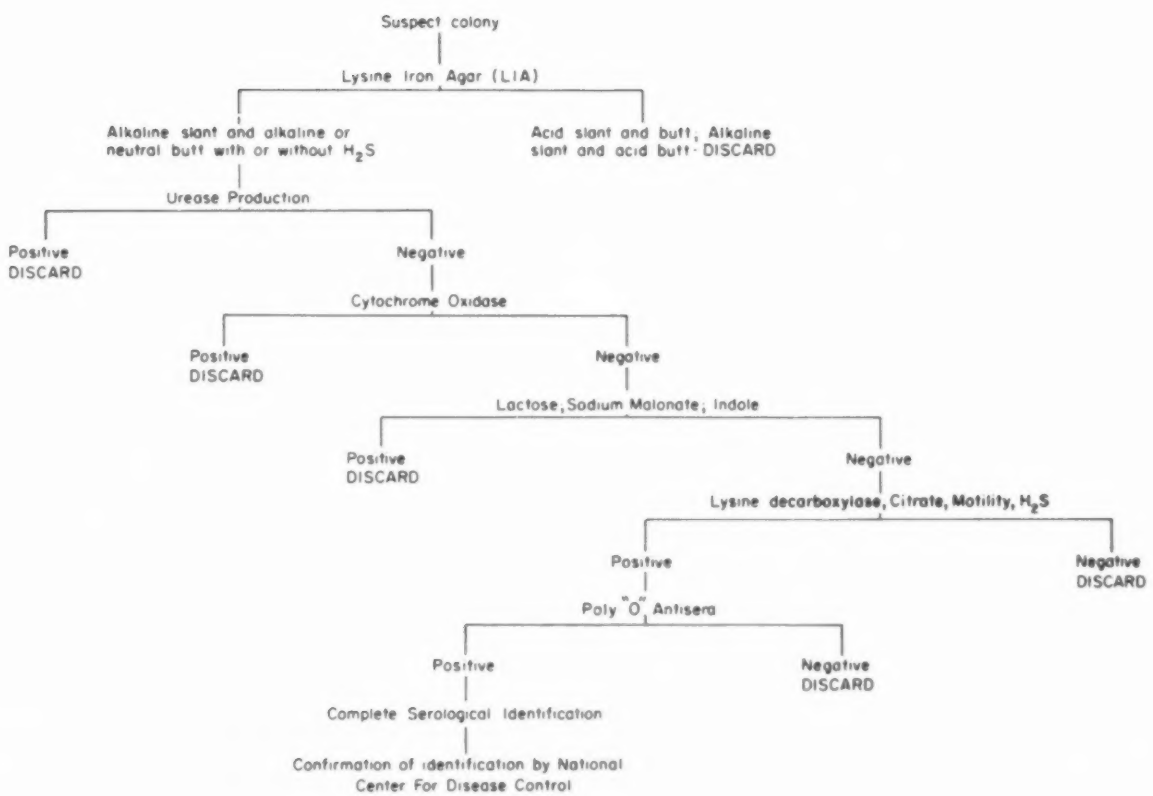
After either primary or subculture enrichment, an inoculum from each enrichment was streaked onto Hekton Enteric Agar and Xylose-Lysine-Desoxycholate Agar (XLD) and incubated for 18-24 hours at 35 ± 0.5°C. Suspect Salmonella colonies were picked from the respected plates and subjected to the identification scheme outlined in Table I.

The methods and media outlined in Table I are described by Ewing (3) with the exception of the cytochrome oxidase procedure. Oxidase was determined using Patho-Tec-CO[1/] reagent impregnated paper strips.

1/ Does not imply endorsement of this product

TABLE B-4

IDENTIFICATION SCHEME FOR SALMONELLA SUSPECTS



REFERENCES

1. American Public Health Association, Standard Methods for the Examination of Water and Wastewater, 13th Edition, 1971.

2. Spino, D. V., "Elevated-temperature Technique for the Isolation of Salmonella from Streams," Appl. Microbiol., 14, No. 4, 1966.

3. Ewing, W. H., "Enterobacteriaceae, Biochemical Methods for Group Differentiation," Public Health Service Publication No. 734, Revised 1962.

APPENDIX C

STREAM AND WASTE QUALITY DATA

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

PAGE	PARAMETER	DESCRIPTION
1	00002	X-SEC. LOC., HORIZ (% FROM R BANK LOOK UPSTR.)
1	00010	TEMPERATURE, WATER (DEGREES CENTIGRADE)
1	00300	OXYGEN, DISSOLVED (MG/L)
1	00400	PH (STANDARD UNITS)
1	00310	BIOCHEMICAL OXYGEN DEMAND (MG/L, 5 DAY - 20DEG C)
1	00403	PH (STANDARD UNITS) LAB
1	00410	ALKALINITY, TOTAL (MG/L AS CACO3)
14	00435	ACIDITY, TOTAL (MG/L AS CACO3)
14	00610	NITROGEN, AMMONIA, TOTAL (MG/L AS N)
14	00625	NITROGEN, KJELDAHL, TOTAL, (MG/L AS N)
14	00630	NITRITE PLUS NITRATE, TOTAL 1 DET. (MG/L AS N)
14	00665	PHOSPHORUS, TOTAL, WET METHOD (MG/L AS P)
14	00666	PHOSPHORUS, DISS., WET METHOD (MG/L AS P)
14	00680	CARBON, TOTAL ORGANIC (MG/L AS C)
18	31501	COLIFORM,TOT,MEMBRANE FILTER,IMMED,M-ENDO MED,35C
18	31616	FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C
18	01027	CADMIUM, TOTAL (UG/L AS CD)
18	01034	CHROMIUM, TOTAL (UG/L AS CR)
18	01042	COPPER, TOTAL (UG/L AS CU)
18	01051	LEAD, TOTAL (UG/L AS PB)
18	01092	ZINC, TOTAL (UG/L AS ZN)
23	01102	TIN, TOTAL (UG/L AS SN)
23	00500	RESIDUE, TOTAL (MG/L)
23	00530	RESIDUE, TOTAL NONFILTRABLE (MG/L)
23	00535	RESIDUE, VOLATILE NONFILTRABLE (MG/L)
23	00058	FLOW RATE (GALLONS PER MINUTE)
23	00335	CHEMICAL OXYGEN DEMAND, .025N K2CR207 (MG/L)
23	00340	CHEMICAL OXYGEN DEMAND, .25N K2CR207 (MG/L)
24	00070	TURBIDITY, (JACKSON CANDLE UNITS)
24	00095	CONDUCTIVITY (MICROMHOS AT 25 DEG C)

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY	PRIMARY STATION	SECONDARY	STATION LOCATION	STATE	MINOR BASIN
11135050	180002	CH	OHIO R.-CHARLESTOWN, IND. STP EF	INDIANA	OHIO RIVER-MAIN STEM
	210626	CK	KENTUCKY R.-CARROLLTON STP EFF	KENTUCKY	OHIO RIVER-MAIN STEM
	210604	DC	OHIO R. AT DOW CORNING CORP. EFF	KENTUCKY	OHIO RIVER-MAIN STEM
	180004	HA	OHIO R.-HANOVER, IND. STP EFF	INDIANA	OHIO RIVER-MAIN STEM
	210592	KC	OHIO R. AT KAWNEER CO. EFF	KENTUCKY	OHIO RIVER-MAIN STEM
	210624	LK	HITE CR-LOUIS. JEFFERSON CO. STP	KENTUCKY	OHIO RIVER-MAIN STEM
	210600	M&T	OHIO R. AT M&T CHEM., INC. EFF	KENTUCKY	OHIO RIVER-MAIN STEM
	180006	MA-EFF	OHIO R.-MADISON, IND. STP EFF	INDIANA	OHIO RIVER-MAIN STEM
	180007	MA-INF	OHIO R.-MADISON, IND. STP INF.	KENTUCKY	OHIO RIVER-MAIN STEM
	210612	O-530.0	OHIO R. 1.5 MI ABV MARKLAND L/D	KENTUCKY	OHIO RIVER-MAIN STEM
	210610	O-532.3	OHIO R. 0.8 MI BLW MARKLAND L/D	KENTUCKY	OHIO RIVER-MAIN STEM
	210608	O-533.8	OHIO R. AT LINDENBURN DAY MARK	KENTUCKY	OHIO RIVER-MAIN STEM
	210606	O-540.4	OHIO R. AT MINNET RUN LIGHT	KENTUCKY	OHIO RIVER-MAIN STEM
	210602	O-542.0	OHIO R. BLW DOW CORNING WASTE EF	KENTUCKY	OHIO RIVER-MAIN STEM
	210598	O-545.0	OHIO R. 1.5 MI BLW M&T CHEM. EFF	KENTUCKY	OHIO RIVER-MAIN STEM
	210596	O-547.9	OHIO R. AT NOTCH LICK LIGHT	KENTUCKY	OHIO RIVER-MAIN STEM
	210594	O-555.6	OHIO R. AT RICHWOOD LIGHT	KENTUCKY	OHIO RIVER-MAIN STEM
	210590	O-561.0	OHIO R. AT CLIFTY CREEK LIGHT	KENTUCKY	OHIO RIVER-MAIN STEM
	210588	O-566.3	OHIO R. AT SPRING CREEK LIGHT	KENTUCKY	OHIO RIVER-MAIN STEM
	210586	O-574.0	OHIO R. AT BETHLEHEM REACH LIGHT	KENTUCKY	OHIO RIVER-MAIN STEM
	210584	O-582.7	OHIO R. AT OLDHAM COUNTY INTAKE	KENTUCKY	OHIO RIVER-MAIN STEM
	210582	O-587.7	OHIO R. 1.7 MI ABV 14 MILE CREEK	KENTUCKY	OHIO RIVER-MAIN STEM
	210580	O-595.0	OHIO R. BLW IND. ARMY AMMU. PLT.	KENTUCKY	OHIO RIVER-MAIN STEM
	210576	O-600.6	OH.R LOUISVILLE WATER INTAKE	KENTUCKY	OHIO RIVER-MAIN STEM
	180000	OP	OHIO R.-OAK PARK CONSER DIST EFF	INDIANA	OHIO RIVER-MAIN STEM
	180008	VE	OHIO R.-VEVAY STP EFF	INDIANA	OHIO RIVER-MAIN STEM

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 1113S050

STATION	DATE	TIME		DATE	TIME	DEPTH	00002 HSAMPLOC % FROM RT BANK	00010 WATER TEMP CENT	00300 DO MG/L	00400 PH SU	00310 BOD 5 DAY MG/L	00403 LAB PH SU	00410 T ALK CACO3 MG/L
0-600.6	720919	0900				0005	25	25.0	5.5	7.1			
0-600.6	720919	0901				0015	25	24.0	5.6	7.2			
0-600.6	720919	0902				0031	25	24.0	5.8	7.2			
0-600.6	720919	0903				0005	50	24.0	5.6	7.2			
0-600.6	720919	0904				0017	50	26.0	5.8	7.2			
0-600.6	720919	0905				0034	50	26.0	5.7	7.2			
0-600.6	720919	0906				0005	75	26.0	5.6	7.2			
0-600.6	720919	0907				0019	75	25.0	5.7	7.2			
0-600.6	720919	0908				0038	75	25.0	5.6	7.2			
0-600.6	720919	0900	(C)	720919	0908	0005					1.1	6.6	50
0-600.6	720920	1908				0005	25	26.0	5.2	7.2			
0-600.6	720920	1909				0015	25	26.0	5.0	7.2			
0-600.6	720920	1910				0030	25	26.0	4.7	7.2			
0-600.6	720920	1911				0005	50	26.0	5.5	7.2			
0-600.6	720920	1912				0018	50	26.0	5.2	7.2			
0-600.6	720920	1913				0036	50	26.0	5.0	7.2			
0-600.6	720920	1914				0005	75	26.0	5.0	7.3			
0-600.6	720920	1915				0019	75	26.0	5.0	7.3			
0-600.6	720920	1916				0038	75	26.0	4.9	7.2			
0-600.6	720920	1908	(C)	720920	1916	0005					0.9	6.8	46
0-600.6	720921	0925				0001	50						
0-600.6	720921	0925				0005	50	26.0	4.6	7.1	1.6	7.1	58
0-600.6	720921	0926				0018	50	26.0	4.6	7.1			
0-600.6	720921	0927				0036	50	26.0	4.6	7.1			
0-600.6	720923	1538				0001	50						
0-600.6	720923	1538				0005	50	25.0	5.1	7.1	1.2	7.2	54
0-600.6	720923	1539				0017	50	25.0	5.2	7.1			
0-600.6	720923	1540				0034	50	25.0	5.3	7.0			
0-595.0	720920	1755				0001	25						
0-595.0	720920	1755				0005	25	27.0	5.1	7.2	1.1	6.8	54
0-595.0	720920	1756				0016	25	26.0	4.6	7.2			
0-595.0	720920	1757				0032	25	26.0	4.7	7.2			
0-595.0	720920	1758				0001	50						
0-595.0	720920	1758				0005	50	27.0	5.3	7.3	1.0	6.8	54
0-595.0	720920	1759				0018	50	27.0	5.0	7.2			
0-595.0	720920	1800				0036	50	26.0	4.7	7.2			
0-595.0	720920	1801				0001	75						

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 1113S050

STATION	DATE	TIME	DATE	TIME	DEPTH	00002 HSAMPLOC % FROM RT BANK	00010 WATER TEMP CENT	00300 DO MG/L	00400 PH SU	00310 BOD 5 DAY MG/L	00403 LAB PH SU	00410 T ALK CACO3 MG/L
0-595.0	720920	1801			0005	75	27.0	5.3	7.2	1.1	6.8	56
0-595.0	720920	1802			0018	75	27.0	4.7	7.2			
0-595.0	720920	1803			0035	75	26.0	4.6	7.2			
0-595.0	720921	0957			0001	50						
0-595.0	720921	0957			0005	50	26.0	5.0	7.0	1.4	7.0	46
0-595.0	720921	0958			0018	50	26.0	5.1	7.0			
0-595.0	720921	0959			0036	50	26.0	5.0	7.0			
0-595.0	720923	1515			0001	50						
0-595.0	720923	1515			0005	50	25.0	4.9	7.1	1.2	7.1	54
0-595.0	720923	1516			0018	50	25.0	4.7	7.1			
0-595.0	720923	1517			0036	50	25.0	4.9	7.0			
0-587.7	720919	1103			0001	50						
0-587.7	720919	1103			0005	50	26.0	5.2	7.0	1.3	6.5	54
0-587.7	720919	1104			0015	50	26.0	5.2	7.1			
0-587.7	720919	1105			0030	50	26.0	5.2	7.1			
0-587.7	720920	1720			0001	50						
0-587.7	720920	1720			0005	50	27.0	5.6	7.3	1.2	6.8	52
0-587.7	720920	1721			0015	50	27.0	5.5	7.2			
0-587.7	720920	1722			0030	50	27.0	5.3	7.2			
0-587.7	720921	1017			0001	50						
0-587.7	720921	1017			0005	50	26.0	5.1	7.1	1.5	7.1	58
0-587.7	720921	1018			0014	50	26.0	5.1	7.1			
0-587.7	720921	1019			0028	50	26.0	5.0	7.0			
0-587.7	720923	1452			0001	50						
0-587.7	720923	1452			0005	50	25.0	6.0	7.2	2.2	7.1	50
0-587.7	720923	1453			0013	50	25.0	5.6	7.2			
0-587.7	720923	1454			0026	50	25.0	5.4	7.2			
0-582.7	720919	1145			0005	25	26.0	4.8	7.1			
0-582.7	720919	1146			0009	25	26.0	4.6	7.1			
0-582.7	720919	1147			0018	25	26.0	4.7	7.1			
0-582.7	720919	1148			0005	50	26.0	4.8	7.1			
0-582.7	720919	1149			0008	50	26.0	4.7	7.1			
0-582.7	720919	1150			0016	50	26.0	4.6	7.1			
0-582.7	720919	1151			0005	75	26.0	4.8	7.1			
0-582.7	720919	1152			0010	75	26.0	4.6	7.1			

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 1113S050

STATION	DATE	TIME		DATE	TIME	DEPTH	00002 MSAMPLOC % FROM RT BANK	00010 WATER TEMP CENT	00300 DO MG/L	00400 PH SU	00310 BOD 5 DAY MG/L	00403 LAB PH SU	00410 T ALK CACO3 MG/L
0-582.7	720919	1153				0020	75	26.0	4.5	7.1			
0-582.7	720919	1145	(C)	720919	1153	0005					1.4	6.5	52
0-582.7	720920	1650				0005	25	27.0	5.7	7.2			
0-582.7	720920	1651				0010	25	27.0	5.2	7.3			
0-582.7	720920	1652				0020	25	26.0	5.2	7.3			
0-582.7	720920	1653				0005	50	26.0	5.4	7.3			
0-582.7	720920	1654				0013	50	26.0	5.2	7.2			
0-582.7	720920	1655				0026	50	26.0	5.2	7.3			
0-582.7	720920	1656				0005	75	26.0	5.3	7.3			
0-582.7	720920	1657				0009	75	26.0	5.3	7.2			
0-582.7	720920	1658				0018	75	26.0	5.3	7.2			
0-582.7	720920	1650	(C)	720920	1658	0005					1.4	6.8	52
0-582.7	720921	1040				0001	50						
0-582.7	720921	1040				0005	50	26.0	4.9	7.1	1.9	7.0	54
0-582.7	720921	1041				0013	50	26.0	5.2	7.1			
0-582.7	720921	1042				0026	50	26.0	4.9	7.1			
0-582.7	720923	1425				0001	50						
0-582.7	720923	1425				0005	50	25.0	6.2	7.3	1.6	7.1	58
0-582.7	720923	1426				0012	50	25.0	6.2	7.3			
0-582.7	720923	1427				0024	50	25.0	6.3	7.3			
0-574.0	720919	1235				0001	50						
0-574.0	720919	1235				0005	50	27.0	5.3	7.2	1.6	6.6	50
0-574.0	720919	1235				0009	50	26.0	5.3	7.2			
0-574.0	720919	1236				0018	50	26.0	5.1	7.2			
0-574.0	720920	1615				0001	50						
0-574.0	720920	1615				0005	50	27.0	5.4	7.1	1.8	6.8	52
0-574.0	720920	1617				0008	50	26.0	5.2	7.1			
0-574.0	720920	1618				0016	50	26.0	5.1	7.1			
0-574.0	720921	1100				0001	50						
0-574.0	720921	1100				0005	50	26.0	5.2	7.2	1.9	7.2	56
0-574.0	720921	1101				0008	50	26.0	5.2	7.1			
0-574.0	720921	1102				0016	50	26.0	5.2	7.1			
0-574.0	720923	1355				0001	50						
0-574.0	720923	1355				0005	50	25.0	6.2	7.3	0.9	7.2	64
0-574.0	720923	1356				0010	50	25.0	5.9	7.3			
0-574.0	720923	1357				0020	50	25.0	6.2	7.3			
0-566.3	720919	1300				0001	50						

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 11135050

STATION	DATE	TIME	DATE	TIME	DEPTH	00002 HSAMPLOC % FROM RT BANK	00010 WATER TEMP CENT	00300 DO MG/L	00400 PH SU	00310 BOD 5 DAY MG/L	00403 LAB PH SU	00410 T ALK CACO3 MG/L
O-566.3	720919	1300			0005	50	27.0	5.4	7.2	1.8	6.5	48
O-566.3	720919	1301			0010	50	26.0	5.1	7.2			
O-566.3	720919	1302			0020	50	26.0	5.0	7.2			
O-566.3	720920	1547			0001	50						
O-566.3	720920	1547			0005	50	26.0	5.4	7.2	1.6	6.8	54
O-566.3	720920	1548			0011	50	26.0	5.1	7.2			
O-566.3	720920	1549			0022	50	26.0	5.1	7.2			
O-566.3	720921	1124			0001	50						
O-566.3	720921	1124			0005	50	26.0	5.7	7.2	2.2	7.2	60
O-566.3	720921	1125			0010	50	26.0	5.7	7.2			
O-566.3	720921	1126			0020	50	26.0	5.8	7.2			
O-566.3	720923	1327			0001	50						
O-566.3	720923	1327			0005	50	25.0	6.6	7.3	1.8	7.2	62
O-566.3	720923	1328			0010	50	25.0	6.3	7.3			
O-566.3	720923	1329			0020	50	25.0	6.2	7.3			
O-561.0	720919	1325			0001	25						
O-561.0	720919	1325			0005	25	27.0	5.0	7.2	1.9	6.5	48
O-561.0	720919	1326			0014	25	27.0	5.1	7.2			
O-561.0	720919	1327			0001	50						
O-561.0	720919	1327			0005	50	27.0	5.1	7.2	1.6	6.2	50
O-561.0	720919	1328			0009	50	26.0	5.0	7.2			
O-561.0	720919	1329			0018	50	26.0	4.9	7.3			
O-561.0	720919	1330			0001	75						
O-561.0	720919	1330			0005	75	26.0	4.9	7.2	1.7	6.5	48
O-561.0	720919	1331			0014	75	26.0	4.9	7.2			
O-561.0	720919	1332			0028	75	26.0	4.7	7.2			
O-561.0	720920	1515			0001	25						
O-561.0	720920	1515			0005	25	27.0	6.1	7.2	2.0	6.9	56
O-561.0	720920	1516			0010	25	27.0	5.7	7.2			
O-561.0	720920	1517			0001	50						
O-561.0	720920	1517			0005	50	27.0	5.6	7.2	1.6	6.9	50
O-561.0	720920	1518			0008	50	26.0	5.7	7.1			
O-561.0	720920	1519			0016	50	26.0	5.6	7.2			
O-561.0	720920	1520			0001	75						
O-561.0	720920	1520			0005	75	26.0	5.6	7.2	1.3	6.7	54
O-561.0	720920	1521			0012	75	26.0	5.2	7.2			
O-561.0	720920	1522			0024	75	26.0	5.1	7.2			

AGENCY - 1113S050

OHIO RIVER (MCALPINE POOL) FIELD STUDY

STATION	DATE	TIME	DATE	TIME	DEPTH	00002 #SAMPLOC % FROM RT BANK	00010 WATER TEMP CENT	00300 DO MG/L	00400 PH SU	00310 BOD 5 DAY MG/L	00403 LAB PH SU	00410 T ALK CACO3 MG/L
0-561.0	720921	1140			0001	50						
0-561.0	720921	1140			0005	50	26.0	5.7	7.2	2.3	7.3	56
0-561.0	720921	1141			0009	50	26.0	5.8	7.2			
0-561.0	720921	1142			0018	50	26.0	5.8	7.2			
0-561.0	720923	1305			0001	50						
0-561.0	720923	1305			0005	50	25.0	6.3	7.4	1.8	7.2	58
0-561.0	720923	1306			0010	50	25.0	6.4	7.4			
0-561.0	720923	1307			0020	50	25.0	6.2	7.3			
0-555.6	720919	1445			0005	25	27.0	5.4	7.2			
0-555.6	720919	1446			0011	25	26.0	5.3	7.2			
0-555.6	720919	1447			0005	50	27.0	5.7	7.2			
0-555.6	720919	1448			0009	50	26.0	5.8	7.2			
0-555.6	720919	1449			0008	50	26.0	5.7	7.3			
0-555.6	720919	1450			0005	75	26.0	5.7	7.3			
0-555.6	720919	1451			0010	75	26.0	5.6	7.2			
0-555.6	720919	1452			0020	75	26.0	5.7	7.2			
0-555.6	720919	1445(C)	720919	1452	0005					1.9	6.4	50
0-555.6	720920	1413			0005	25	26.0	6.2	7.2			
0-555.6	720920	1414			0005	50	26.0	5.7	7.2			
0-555.6	720920	1415			0008	50	26.0	5.6	7.2			
0-555.6	720920	1416			0016	50	26.0	5.6	7.2			
0-555.6	720920	1417			0005	75	26.0	5.3	7.2			
0-555.6	720920	1418			0008	75	26.0	5.6	7.1			
0-555.6	720920	1419			0016	75		5.5				
0-555.6	720920	1413(C)	720920	1419	0005					1.6	6.7	52
0-555.6	720921	1255			0001	50						
0-555.6	720921	1255			0005	50	26.0	5.7	7.3	2.0	7.1	64
0-555.6	720921	1256			0014	50	26.0	5.4	7.3			
0-555.6	720922	1325			0001	50						
0-555.6	720922	1325			0005	50	26.0	6.3	7.3	2.7	7.2	56
0-555.6	720922	1326			0008	50	25.0	6.4	7.3			
0-555.6	720922	1327			0015	50	25.0	6.6	7.3			
0-555.6	720923	1223			0001	50						
0-555.6	720923	1223			0005	50	24.0	6.1	7.3	2.2	7.2	58
0-555.6	720923	1224			0014	50	24.0	6.0	7.3			
0-547.9	720919	1520			0001	25						

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 1113S050

STATION	DATE	TIME	DATE	TIME	DEPTH	00002 HSAMPLOC % FROM RT BANK	00010 WATER TEMP CENT	00300 DO MG/L	00400 PH SU	00310 BOD 5 DAY MG/L	00403 LAB PH SU	00410 T ALK CACO3 MG/L
0-547.9	720919	1520			0005	25	27.0	4.6	7.1	2.1	6.6	58
0-547.9	720919	1521			0010	25	26.0	4.4	7.1			
0-547.9	720919	1522			0020	25	26.0	4.5	7.1			
0-547.9	720919	1523			0001	50						
0-547.9	720919	1523			0005	50	26.0	4.2	7.1	2.2	6.5	52
0-547.9	720919	1524			0010	50	26.0	4.2	7.1			
0-547.9	720919	1525			0020	50	26.0	4.0	7.1			
0-547.9	720919	1526			0001	75						
0-547.9	720919	1526			0005	75	26.0	4.4	7.2	1.9	6.6	54
0-547.9	720919	1527			0014	75	26.0	4.2	7.2			
0-547.9	720920	1330			0001	25						
0-547.9	720920	1330			0005	25	26.0	6.2	7.1	2.0	6.7	56
0-547.9	720920	1331			0009	25	26.0	6.3	7.2			
0-547.9	720920	1332			0018	25	26.0	6.0	7.2			
0-547.9	720920	1333			0001	50						
0-547.9	720920	1333			0005	50	26.0	5.7	7.2	1.7	6.7	60
0-547.9	720920	1334			0009	50	26.0	5.4	7.1			
0-547.9	720920	1335			0018	50	26.0	5.4	7.2			
0-547.9	720920	1336			0001	75						
0-547.9	720920	1336			0005	75	26.0	5.5	7.2	1.5	6.8	52
0-547.9	720921	1315			0001	50						
0-547.9	720921	1315			0005	50	27.0	6.5	7.2	1.7	7.1	60
0-547.9	720921	1316			0010	50	27.0	5.3	7.2			
0-547.9	720921	1317			0020	50	27.0	5.0	7.2			
0-547.9	720922	1245			0001	25						
0-547.9	720922	1245			0005	25	25.0	5.9	7.3	2.0	7.2	62
0-547.9	720922	1246			0009	25	24.0	6.1	7.3			
0-547.9	720922	1247			0018	25	25.0	6.1	7.2			
0-547.9	720922	1248			0001	50						
0-547.9	720922	1248			0005	50	24.0	5.9	7.3	3.7	7.2	58
0-547.9	720922	1249			0010	50	24.0	5.9	7.2			
0-547.9	720922	1250			0020	50	25.0	5.7	7.2			
0-547.9	720922	1251			0001	75						
0-547.9	720922	1251			0005	75	25.0	5.9	7.3	2.4	7.2	60
0-547.9	720922	1252			0011	75	25.0	5.7	7.2			
0-547.9	720923	1140			0001	25						
0-547.9	720923	1140			0005	25	25.0	5.6	7.3	1.9	7.1	64
0-547.9	720923	1141			0010	25	25.0	5.6	7.3			
0-547.9	720923	1142			0020	25	25.0	5.3	7.2			

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 11135050

STATION	DATE	TIME	DATE	TIME	DEPTH	00002 HSAMPLOC % FROM RT BANK	00010 WATER TEMP CENT	00300 DO MG/L	00400 PH SU	00310 BOD 5 DAY MG/L	00403 LAB PH SU	00410 T ALK CACO3 MG/L
0-547.9	720923	1143			0001	50						
0-547.9	720923	1143			0005	50	25.0	5.5	7.2	1.8	7.1	66
0-547.9	720923	1144			0009	50	25.0	5.5	7.2			
0-547.9	720923	1145			0018	50	25.0	5.5	7.3			
0-547.9	720923	1146			0001	75						
0-547.9	720923	1146			0005	75	24.0	5.6	7.2	1.9	7.1	56
0-547.9	720923	1147			0012	75	25.0	5.6	7.3			
0-545.0	720919	1620			0001	25						
0-545.0	720919	1620			0005	25	26.0	5.1	7.1	2.0	6.7	50
0-545.0	720919	1621			0011	25	26.0	4.7	7.2			
0-545.0	720919	1622			0001	50						
0-545.0	720919	1622			0005	50	26.0	4.9	7.2	1.9	6.6	48
0-545.0	720919	1623			0012	50	26.0	5.0	7.2			
0-545.0	720919	1624			0001	75						
0-545.0	720919	1624			0004	75	26.0	4.8	7.2	2.1	6.7	44
0-545.0	720920	1250			0001	25						
0-545.0	720920	1250			0005	25	26.0	6.1	7.1	1.6	6.7	52
0-545.0	720920	1251			0012	25	26.0	6.2	7.0			
0-545.0	720920	1252			0001	50						
0-545.0	720920	1252			0005	50	26.0	5.4	7.1	1.8	6.8	56
0-545.0	720920	1253			0011	50	26.0	5.5	7.1			
0-545.0	720920	1254			0001	75						
0-545.0	720920	1254			0005	75	26.0	5.2	7.1	1.8	6.7	58
0-545.0	720920	1255			0011	75	26.0	5.1	7.1			
0-545.0	720921	1339			0001	50						
0-545.0	720921	1339			0005	50	26.0	5.1	7.2	1.8	7.2	64
0-545.0	720921	1340			0010	50	26.0	5.3	7.2			
0-545.0	720922	1208			0001	25						
0-545.0	720922	1208			0005	25	24.0	5.9	7.2	2.0	6.8	56
0-545.0	720922	1209			0011	25	24.0	5.9	7.2			
0-545.0	720922	1210			0001	50						
0-545.0	720922	1210			0005	50	24.0	5.6	7.3	1.5	6.9	56
0-545.0	720922	1211			0011	50	25.0	5.6	7.3			
0-545.0	720922	1212			0001	75						
0-545.0	720922	1212			0005	75	25.0	5.6	7.3	1.6	6.9	54
0-545.0	720923	1055			0001	25						
0-545.0	720923	1055			0005	25	24.0	5.4	7.4	2.0	7.2	52

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 1113S050

STATION	DATE	TIME	DATE	TIME	DEPTH	00002 HSAMPLOC % FROM RT BANK	00010 WATER TEMP CENT	00300 DO MG/L	00400 PH SU	00310 BOD 5 DAY MG/L	00403 LAB PH SU	00410 T ALK CACO3 MG/L
0-545.0	720923	1056			0012	25	24.0	5.4	7.3			
0-545.0	720923	1057			0001	50						
0-545.0	720923	1057			0005	50	24.0	5.2	7.3	2.2	7.0	62
0-545.0	720923	1058			0011	50	24.0	5.2	7.3			
0-545.0	720923	1059			0001	75						
0-545.0	720923	1059			0005	75	24.0	5.3	7.3	1.7	7.1	60
0-545.0	720923	1100			0010	75	24.0	5.3	7.2			
0-542.0	720919	1645			0001	50						
0-542.0	720919	1645			0005	50	26.0	6.2	7.1	1.8	6.7	50
0-542.0	720919	1646			0013	50	26.0	5.9	7.2			
0-542.0	720920	1235			0001	50						
0-542.0	720920	1235			0005	50	26.0	5.8	7.1	1.8	6.6	54
0-542.0	720920	1236			0013	25	25.0	5.8	7.1			
0-542.0	720921	1350			0001	50						
0-542.0	720921	1350			0005	50	26.0	5.5	7.2	2.1	7.1	50
0-542.0	720921	1351			0013	50	27.0	5.6	7.2			
0-542.0	720922	1155			0001	50						
0-542.0	720922	1155			0005	50	24.0	5.3	7.3	1.6	6.8	60
0-542.0	720922	1156			0011	50	24.0	5.6	7.3			
0-542.0	720923	1040			0001	50						
0-542.0	720923	1040			0005	50	24.0	5.3	7.3	2.2	7.0	62
0-542.0	720923	1041			0013	50	24.0	5.2	7.3			
0-540.4	720919	1655			0004	25	26.0	6.6	7.2			
0-540.4	720919	1700			0005	50	26.0	5.6	7.2			
0-540.4	720919	1701			0014	50	26.0		7.2			
0-540.4	720919	1702			0005	75	26.0	5.0	7.2			
0-540.4	720919	1703			0009	75	26.0	4.7	7.2			
0-540.4	720919	1704			0018	75	26.0	4.9	7.2			
0-540.4	720919	1655(C)	720919	1704	0005					2.4	6.6	48
0-540.4	720920	1150			0004	25	25.0	4.9	7.1			
0-540.4	720920	1151			0005	50	26.0	5.9	7.1			
0-540.4	720920	1152			0008	50	26.0	5.3	7.1			
0-540.4	720920	1153			0016	50	25.0	5.4	7.2			
0-540.4	720920	1154			0005	75	26.0	4.9	7.1			
0-540.4	720920	1155			0008	75	25.0	5.0	7.1			

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 11135050

STATION	DATE	TIME		DATE	TIME	DEPTH	00002 HSAMPLOC % FROM RT BANK	00010 WATER TEMP CENT	00300 DO MG/L	00400 PH SU	00310 BOD 5 DAY MG/L	00403 LAB PH SU	00410 T ALK CACO3 MG/L
0-540.4	720920	1156				0016	75	26.0	4.9	7.1			
0-540.4	720920	1150	(C)	720920	1156	0005					1.7	6.6	60
0-540.4	720921	1400				0001	50						
0-540.4	720921	1400				0005	50	26.0	5.6	7.2	1.7	7.1	58
0-540.4	720921	1401				0012	50	26.0	5.9	7.2			
0-540.4	720922	1140				0004	25	24.0	6.1	7.3			
0-540.4	720922	1141				0005	50	24.0	5.4	7.3			
0-540.4	720922	1142				0014	50	25.0	5.4	7.3			
0-540.4	720922	1143				0005	75	24.0	5.5	7.4			
0-540.4	720922	1144				0009	75	24.0	5.4	7.3			
0-540.4	720922	1145				0018	75	24.0	5.2	7.3			
0-540.4	720922	1140	(C)	720922	1145	0005					1.7	6.7	58
0-540.4	720923	1018				0004	25	24.0	5.5	7.3			
0-540.4	720923	1019				0005	50	24.0	5.2	7.2			
0-540.4	720923	1021				0014	50	24.0	5.2	7.3			
0-540.4	720923	1022				0005	75	24.0	5.2	7.3			
0-540.4	720923	1023				0010	75	24.0	5.2	7.3			
0-540.4	720923	1024				0020	75	25.0	5.1	7.3			
0-540.4	720923	1018	(C)	720923	1024	0005					2.0	7.0	56
0-533.8	720919	1740				0005	25	26.0	6.1	7.1			
0-533.8	720919	1741				0009	25	26.0	6.1	7.1			
0-533.8	720919	1742				0018	25	26.0	6.2	7.2			
0-533.8	720919	1743				0005	50	26.0	5.8	7.2			
0-533.8	720919	1744				0011	50	26.0	5.8	7.2			
0-533.8	720919	1745				0022	50	26.0	5.8	7.2			
0-533.8	720919	1746				0005	75	26.0	5.1	7.2			
0-533.8	720919	1747				0008	75	26.0	4.8	7.2			
0-533.8	720919	1748				0016	75	26.0	4.8	7.1			
0-533.8	720919	1740	(C)	720919	1748	0005					1.8	6.6	48
0-533.8	720920	1108				0004	25	25.0	6.1	7.2			
0-533.8	720920	1109				0005	50	25.0	5.3	7.2			
0-533.8	720920	1110				0010	50	25.0	5.3	7.1			
0-533.8	720920	1111				0020	50	25.0	5.2	7.2			
0-533.8	720920	1112				0005	75	25.0	5.0	7.2			
0-533.8	720920	1113				0013	75	25.0	4.9	7.2			
0-533.8	720920	1114				0026	75	25.0	4.9	7.1			
0-533.8	720920	1108	(C)	720920	1114	0005					1.8	6.6	64

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 11135050

STATION	DATE	TIME	DATE	TIME	DEPTH	00002 HSAMPLOC % FROM RT BANK	00010 WATER TEMP CENT	00300 DO MG/L	00400 PH SU	00310 BOD 5 DAY MG/L	00403 LAB PH SU	00410 T ALK CACO3 MG/L
0-533.8	720921	1418			0001	50						
0-533.8	720921	1418			0005	50	26.0	5.6	7.3	1.7	7.1	56
0-533.8	720921	1419			0011	50	26.0	5.5	7.2			
0-533.8	720921	1420			0022	50	26.0	5.5	7.2			
0-533.8	720922	1120			0005	50	24.0	5.1	7.2	2.0	6.7	58
0-533.8	720922	1121			0010	50	24.0	4.9	7.2			
0-533.8	720922	1122			0020	50	25.0	5.0	7.2			
0-533.8	720923	1000			0001	50						
0-533.8	720923	1000			0005	50	24.0	5.3	7.2	2.0	6.9	58
0-533.8	720923	1001			0010	50	25.0	5.3	7.2			
0-533.8	720923	1002			0020	50	25.0	5.3	7.2			
0-532.3	720920	1030			0005	25	25.0	4.9	7.0			
0-532.3	720920	1031			0008	25	25.0	4.9	7.1			
0-532.3	720920	1032			0016	25	25.0	4.9	7.1			
0-532.3	720920	1033			0005	50	25.0	4.7	7.2			
0-532.3	720920	1034			0011	50	25.0	4.8	7.1			
0-532.3	720920	1035			0005	75	25.0	5.0	7.1			
0-532.3	720920	1036			0012	75	25.0	4.7	7.1			
0-532.3	720920	1030	(C) 720920	1036	0005					2.0	6.6	58
0-532.3	720921	1430			0001	50						
0-532.3	720921	1430			0005	50	26.0	5.3	7.2	2.4	7.1	56
0-532.3	720921	1431			0012	50	26.0	5.4	7.2			
0-532.3	720922	1115			0001	50						
0-532.3	720922	1115			0005	50	24.0	4.9	7.2	2.0	6.7	64
0-532.3	720922	1116			0012	50	24.0	5.0	7.2			
0-532.3	720923	0950			0001	50						
0-532.3	720923	0950			0005	50	24.0	5.3	7.2	2.2	7.0	64
0-532.3	720923	0952			0011	50	24.0	5.3	7.3			
0-530.0	720919	1905			0005	25	26.0	5.1	7.2			
0-530.0	720919	1906			0018	25	26.0	5.1	7.2			
0-530.0	720919	1907			0036	25	25.0	4.6	7.2			
0-530.0	720919	1908			0005	50	26.0	5.0	7.2			
0-530.0	720919	1909			0018	50	26.0	4.7	7.2			
0-530.0	720919	1910			0036	50	25.0	4.7	7.2			
0-530.0	720919	1911			0005	75	26.0	5.1	7.2			

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 1113S050

STATION	DATE	TIME		DATE	TIME	DEPTH	00002 HSAMPLOC % FROM RT BANK	00010 WATER TEMP CENT	00300 DO MG/L	00400 PH SU	00310 BOD 5 DAY MG/L	00403 LAB PH SU	00410 T ALK CACO3 MG/L
0-530.0	720919	1912				0018	75	25.0	4.8	7.2			
0-530.0	720919	1913				0036	75	25.0	4.7	7.2			
0-530.0	720919	1905	(C)	720919	1913	0005					2.8	6.7	52
0-530.0	720920	0940				0005	25	24.0	4.8	7.2			
0-530.0	720920	0941				0018	25	24.0	4.8	7.2			
0-530.0	720920	0942				0036	25	24.0	4.6	7.3			
0-530.0	720920	0943				0005	50	24.0	5.0	7.2			
0-530.0	720920	0944				0018	50	24.0	5.1	7.2			
0-530.0	720920	0945				0036	50	24.0	4.8	7.2			
0-530.0	720920	0946				0005	75	24.0	5.0	7.2			
0-530.0	720920	0947				0018	75	24.0	4.8	7.3			
0-530.0	720920	0948				0036	75	24.0	4.9	7.3			
0-530.0	720920	0940	(C)	720920	0948	0005					1.5	6.8	50
0-530.0	720921	1500				0001	50						
0-530.0	720921	1500				0005	50				1.8	7.2	58
0-530.0	720921	1501				0018	50	27.0	4.8	7.2			
0-530.0	720921	1502				0036	50	27.0	4.7	7.2			
0-530.0	720922	1021				0005	25	24.0	4.9	7.2			
0-530.0	720922	1022				0018	25	24.0	5.1	7.2			
0-530.0	720922	1023				0036	25	24.0	5.0	7.2			
0-530.0	720922	1024				0005	50	24.0	5.0	7.2			
0-530.0	720922	1025				0018	50	24.0	4.9	7.2			
0-530.0	720922	1026				0036	50	24.0	5.1	7.2			
0-530.0	720922	1027				0005	75	24.0	4.9	7.2			
0-530.0	720922	1028				0018	75	24.0	4.9	7.2			
0-530.0	720922	1029				0036	75	24.0	4.9	7.2			
0-530.0	720922	1021	(C)	720922	1029	0005					1.8	6.8	62
0-530.0	720923	0852				0005	25	24.0	5.5	7.2			
0-530.0	720923	0853				0016	25	24.0	5.9	7.2			
0-530.0	720923	0854				0032	25	24.0	5.5	7.2			
0-530.0	720923	0855				0005	50	24.0	5.7	7.2			
0-530.0	720923	0856				0018	50	25.0	5.3	7.2			
0-530.0	720923	0857				0036	50	25.0		7.2			
0-530.0	720923	0858				0005	75	24.0	5.5	7.3			
0-530.0	720923	0859				0018	75	24.0	5.6	7.2			
0-530.0	720923	0900				0036	75	24.0	5.6	7.2			
0-530.0	720923	0852	(C)	720923	0900	0005					2.4	7.1	54
KC	720921	1500	(C)	720922	1200						4.5	7.4	226

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 1113S050

STATION	DATE	TIME		DATE	TIME	DEPTH	00002 HSAMPLOC % FROM RT BANK	00010 WATER TEMP CENT	00300 DO MG/L	00400 PH SU	00310 BOD 5 DAY MG/L	00403 LAB PH SU	00410 T ALK CACO3 MG/L
KC	720922	1200	(C)	720923	0945						3.2	7.5	186
M&T	720921	1200								7.6			
M&T	720922	1115						20.0		7.6			
M&T	720921	1200	(C)	720922	1115						125.0	7.8	236
M&T	720923	1045						20.0		7.6	50.0	7.9	214
DC	720922	1030						22.5		7.4			
DC	720921	1045	(C)	720922	1030						6.0	7.5	246
DC	720922	1030	(C)	720923	1000						1.4	7.7	240
LK	720922	0900						24.0		7.2			
LK	720921	0900	(C)	720922	0900						13.0	7.2	
CK	720921	1330						22.5		6.8			
CK	720922	1330						24.0		7.2			
CK	720921	1330	(C)	720922	1330						205.0	7.1	
OP	720919	0930						23.0		6.5			
OP	720920	0830						26.0		6.5			
OP	720919	0930	(C)	720920	0830						175.0		380
CH	720919	1100						23.0		7.0			
CH	720920	1000						23.0		7.0			
CH	720919	1100	(C)	720920	1000						170.0		270
HA	720919	1300						26.0		7.5			
HA	720920	1100						23.0		7.4			
HA	720919	1300	(C)	720920	1100						93.0		365
VE	720920	1615	(C)	720921	1030					7.6	5.0K		305

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 1113S050

STATION	DATE	TIME		DATE	TIME	DEPTH	00002 HSAMPLOC % FROM RT BANK	00010 WATER TEMP CENT	00300 DO MG/L	00400 PH SU	00310 BOD 5 DAY MG/L	00403 LAB PH SU	00410 T ALK CACO3 MG/L
VE	720921	1045						23.0		7.3			
MA-EFF	720919	1450						25.0		7.0			
MA-EFF	720920	1200						24.0		7.4			
MA-EFF	720919	1450	(C)	720920	1200						210.0		300
MA-EFF	720921	0930						22.0		6.9			
MA-EFF	720920	1200	(C)	720921	0930					7.4	220.0		310

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 1113S050

STATION	DATE	TIME		DATE	TIME	DEPTH	00435 T ACDITY CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00665 PHOS-T P-WET MG/L	00666 PHOS-D P-WET MG/L	00680 T ORG C C MG/L
0-600.6	720919	0900	(C)	720919	0908	0005	5	0.06	0.35	1.37	0.09	0.09	4.0
0-600.6	720920	1908	(C)	720920	1916	0005	5	0.04	0.55	1.64	0.10	0.10	3.4
0-600.6	720921	0925				0005	4	0.04	0.49	1.59	0.11	0.11	4.4
0-600.6	720923	1538				0005	10	0.04	0.47	1.55	0.10	0.08	2.8
0-595.0	720920	1755				0005	5	0.03	0.43	1.64	0.11	0.10	7.2
0-595.0	720920	1758				0005	5	0.03	0.36	1.65	0.09	0.09	4.5
0-595.0	720920	1801				0005	5	0.03	0.52	1.62	0.09	0.09	4.8
0-595.0	720921	0957				0005	5	0.04	0.61	1.59	0.10	0.10	4.8
0-595.0	720923	1515				0005	5	0.06	0.47	1.62	0.09	0.09	2.8
0-587.7	720919	1103				0005	4	0.04	0.49	1.61	0.12	0.10	5.6
0-587.7	720920	1720				0005	4	0.03	0.43	1.59	0.10	0.09	4.8
0-587.7	720921	1017				0005	5	0.03	0.45	1.57	0.09	0.09	4.5
0-587.7	720923	1452				0005	5	0.04	0.50	1.48	0.09	0.08	2.8
0-582.7	720919	1145	(C)	720919	1153	0005	6	0.06	0.44	1.54	0.11	0.10	5.3
0-582.7	720920	1650	(C)	720920	1658	0005	5	0.02	0.35	1.59	0.10	0.09	4.7
0-582.7	720921	1040				0005	5	0.04	0.47	1.54	0.10	0.10	3.9
0-582.7	720923	1425				0005	5	0.03	0.55	1.42	0.08	0.08	3.1
0-574.0	720919	1235				0005	6	0.04	0.43	1.59	0.10	0.09	4.2
0-574.0	720920	1615				0005	5	0.09	0.59	1.52	0.10	0.10	5.6
0-574.0	720921	1100				0005	6	0.08	0.45	1.45	0.10	0.10	3.8
0-574.0	720923	1355				0005	5	0.02	0.43	1.52	0.10	0.10	3.1
0-566.3	720919	1300				0005	6	0.04	0.43	1.55	0.09	0.09	4.2
0-566.3	720920	1547				0005	5	0.18	0.53	1.41	0.10	0.10	5.2
0-566.3	720921	1124				0005	5	0.05	0.47	1.36	0.10	0.09	4.0
0-566.3	720923	1327				0005	5	0.02	0.50	1.45	0.11	0.09	3.8
0-561.0	720919	1325				0005	3	0.07	0.46	1.51	0.10	0.09	5.6
0-561.0	720919	1327				0005	8	0.09	0.52	1.52	0.10	0.09	4.2

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 1113S050

STATION	DATE	TIME	DATE	TIME	DEPTH	00435 T ACIDITY CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00665 PHOS-T P-WET MG/L	00666 PHOS-D P-WET MG/L	00680 T ORG C C MG/L
0-561.0	720919	1330			0005	6	0.08	0.40	1.52	0.10	0.09	4.5
0-561.0	720920	1515			0005	5	0.16	0.43	1.38	0.10	0.10	5.3
0-561.0	720920	1517			0005	4	0.15	0.43	1.39	0.10	0.09	6.3
0-561.0	720920	1520			0005	5	0.15	0.48	1.38	0.09	0.09	4.7
0-561.0	720921	1140			0005	5	0.06	0.49	1.37	0.10	0.10	3.8
0-561.0	720923	1305			0005	5	0.03	0.49	1.43	0.08	0.08	4.1
0-555.6	720919	1445(C)	720919	1452	0005	4	0.18	0.52	1.44	0.12	0.10	5.6
0-555.6	720920	1413(C)	720920	1419	0005	6	0.21	0.69	1.34	0.09	0.08	5.2
0-555.6	720921	1255			0005	5	0.07	0.49	1.43	0.12	0.11	3.8
0-555.6	720922	1325			0005	5	0.04	0.51	1.43	0.11	0.09	4.8
0-555.6	720923	1223			0005	5	0.09	0.55	1.43	0.08	0.08	4.1
0-547.9	720919	1520			0005	5	0.29	0.44	1.36	0.12	0.10	5.0
0-547.9	720919	1523			0005	5	0.29	0.59	1.36	0.12	0.10	5.5
0-547.9	720919	1526			0005	5	0.27	0.63	1.43	0.12	0.10	4.5
0-547.9	720920	1330			0005	4	0.09	0.52	1.27	0.11	0.10	6.8
0-547.9	720920	1333			0005	5	0.10	0.39	1.32	0.10	0.10	5.2
0-547.9	720920	1336			0005	5	0.07	0.49	1.35	0.09	0.09	6.0
0-547.9	720921	1315			0005	4	0.18	0.48	1.36	0.12	0.10	3.4
0-547.9	720922	1245			0005	4	0.10	0.52	1.32	0.10	0.08	4.4
0-547.9	720922	1248			0005	4	0.10	0.49	1.32	0.09	0.08	4.8
0-547.9	720922	1251			0005	4	0.06	0.45	1.43	0.09	0.08	4.6
0-547.9	720923	1140			0005	5	0.18	0.52	1.39	0.09	0.08	4.1
0-547.9	720923	1143			0005	5	0.17	0.60	1.45	0.11	0.08	4.8
0-547.9	720923	1146			0005	5	0.16	0.54	1.45	0.09	0.09	4.4
0-545.0	720919	1620			0005	4	0.28	0.70	1.37	0.12	0.10	4.7
0-545.0	720919	1622			0005	5	0.28	0.54	1.29	0.12	0.09	4.4
0-545.0	720919	1624			0004	5	0.29	0.70	1.37	0.12	0.10	5.2
0-545.0	720920	1250			0005	4	0.10	0.49	1.35	0.11	0.10	3.5
0-545.0	720920	1252			0005	4	0.10	0.48	1.30	0.11	0.11	3.5
0-545.0	720920	1254			0005	4	0.09	0.50	1.35	0.11	0.10	3.9
0-545.0	720921	1339			0005	5	0.07	0.48	1.39	0.10	0.10	3.4
0-545.0	720922	1208			0005	5	0.16	0.52	1.43	0.13	0.08	4.9

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 1113S050

STATION	DATE	TIME	DATE	TIME	DEPTH	00435 T ACDITY CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00665 PHOS-T P-WET MG/L	00666 PHOS-D P-WET MG/L	00680 T ORG C C MG/L
0-545.0	720922	1212			0005	4	0.18	0.58	1.40	0.09	0.09	4.8
0-545.0	720923	1055			0005	5	0.12	0.66	1.42	0.10	0.08	4.8
0-545.0	720923	1057			0005	5	0.19	0.68	1.46	0.10	0.09	4.1
0-545.0	720923	1059			0005	5	0.17	0.62	1.51	0.08	0.08	4.1
0-542.0	720919	1645			0005	5	0.27	0.96	1.36	0.12	0.09	5.6
0-542.0	720920	1235			0005	4	0.15	0.47	1.39	0.12	0.11	3.7
0-542.0	720921	1350			0005	5	0.07	0.52	1.43	0.10	0.10	3.8
0-542.0	720922	1155			0005	4	0.17	0.56	1.39	0.09	0.08	4.0
0-542.0	720923	1040			0005	5	0.16	0.60	1.41	0.10	0.08	3.9
0-540.4	720919	1655(C)	720919	1704	0005	5	0.24	0.96	1.31	0.12	0.09	4.5
0-540.4	720920	1150(C)	720920	1156	0005	4	0.15	0.46	1.33	0.11	0.10	3.5
0-540.4	720921	1400			0005	5	0.07	0.50	1.37	0.10	0.09	3.8
0-540.4	720922	1140(C)	720922	1145	0005	4	0.18	0.52	1.39	0.10	0.09	4.0
0-540.4	720923	1018(C)	720923	1024	0005	5	0.17	0.62	1.41	0.08	0.08	3.8
0-533.8	720919	1740(C)	720919	1748	0005	4	0.23	0.40	1.27	0.10	0.09	5.3
0-533.8	720920	1108(C)	720920	1114	0005	4	0.16	0.51	1.40	0.12	0.11	3.7
0-533.8	720921	1418			0005	4	0.10	0.54	1.38	0.10	0.09	3.3
0-533.8	720922	1120			0005	4	0.32	0.68	1.39	0.11	0.09	4.0
0-533.8	720923	1000			0005	5	0.15	1.05	1.40	0.10	0.08	4.1
0-532.3	720920	1030(C)	720920	1036	0005	4	0.17	0.46	1.38	0.13	0.11	4.0
0-532.3	720921	1430			0005	5	0.10	0.52	1.40	0.09	0.08	3.8
0-532.3	720922	1115			0005	5	0.21	0.60	1.37	0.11	0.09	4.0
0-532.3	720923	0950			0005	5	0.15	0.75	1.40	0.10	0.08	4.8
0-530.0	720919	1905(C)	720919	1913	0005	4	0.19	0.31	1.26	0.10	0.10	5.0
0-530.0	720920	0940(C)	720920	0948	0005	4	0.34	0.43	1.37	0.12	0.11	4.7
0-530.0	720921	1500			0005	5	0.19	0.49	1.35	0.11	0.10	3.8
0-530.0	720922	1021(C)	720922	1029	0005	4	0.23	0.60	1.36	0.10	0.10	4.0
0-530.0	720923	0852(C)	720923	0900	0005	5	0.15	0.64	1.49	0.09	0.07	4.8

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 1113S050

STATION	DATE	TIME	DATE	TIME	DEPTH	00435 T ACDITY CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00665 PHOS-T P-WET MG/L	00666 PHOS-D P-WET MG/L	00680 T ORG C C MG/L
KC	720922	1200(C)	720923	0945		10	0.07	0.62	8.40	5.60		1.6
M&T	720921	1200(C)	720922	1115		8	30.00	30.00	1.20	0.45		27.0
M&T	720923	1045				13	36.00	42.00	1.02	0.90		41.0
DC	720921	1045(C)	720922	1030		12	0.15	0.60	2.14	0.01		4.1
DC	720922	1030(C)	720923	1000		11	0.09	0.62	2.10	0.01K		2.5
LK	720921	0900(C)	720922	0900			0.39	1.21	0.66	0.80		17.0
CK	720921	1330(C)	720922	1330			28.00	33.00	0.05	16.70		106.0
OP	720919	0930(C)	720920	0830			28.00	29.00	0.10K	14.50		87.0
CH	720919	1100(C)	720920	1000			27.00	30.00	0.15	14.50		57.0
HA	720919	1300(C)	720920	1100			22.00	28.00	0.20	14.50		86.0
VE	720920	1615(C)	720921	1030			0.03	1.15	29.00	11.50		10.0K
MA-EFF	720919	1450(C)	720920	1200			20.00	25.50	0.10K	10.50		135.0
MA-EFF	720920	1200(C)	720921	0930			20.50	22.00	0.25	9.80		110.0

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 1113S050

STATION	DATE	TIME		DATE	TIME	DEPTH	31501 TOT COLI MFIMENDO /100ML	31616 FEC COLI MFM-FCBR /100ML	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L	01051 LEAD PB,TOT UG/L	01092 ZINC ZN,TOT UG/L
0-600.6	720919	0900	(C)	720919	0908	0001	1100	70					
0-600.6	720920	1908	(C)	720920	1916	0001	270	22					
0-600.6	720921	0925				0001	540	96					
0-600.6	720923	1538				0001	350	34					
0-595.0	720920	1755				0001	150	20					
0-595.0	720920	1758				0001	540	8					
0-595.0	720920	1801				0001	160	20					
0-595.0	720921	0957				0001	400	38					
0-595.0	720923	1515				0001	1100	74					
0-587.7	720919	1103				0001	700	36					
0-587.7	720920	1720				0001	250	12					
0-587.7	720921	1017				0001	330	94					
0-587.7	720923	1452				0001	420	24					
0-582.7	720919	1145	(C)	720919	1153	0001	840	74					
0-582.7	720920	1650	(C)	720920	1658	0001	860	86					
0-582.7	720921	1040				0001	5700	170					
0-582.7	720923	1425				0001	320	28					
0-574.0	720919	1235				0001	1600	92					
0-574.0	720920	1615				0001	5000	350					
0-574.0	720921	1100				0001	640	140					
0-574.0	720923	1355				0001	600	40					
0-566.3	720919	1300				0001	6900	520					
0-566.3	720920	1547				0001	3300	190					
0-566.3	720921	1124				0001	4400	720					
0-566.3	720923	1327				0001	4600	430					

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 1113S050

STATION	DATE	TIME	DATE	TIME	DEPTH	31501 TOT COLI MFIMENDO /100ML	31616 FEC COLI MFM-FCBR /100ML	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L	01051 LEAD PB,TOT UG/L	01092 ZINC ZN,TOT UG/L
0-561.0	720919	1330			0001	22000	1300					
0-561.0	720920	1515			0001	4300	300					
0-561.0	720920	1517			0001	5800	300					
0-561.0	720920	1520			0001	6800	440					
0-561.0	720921	1140			0001	4100	250					
0-561.0	720923	1305			0001	2500	180					
0-555.6	720919	1445(C)	720919	1452	0001	2800	150					
0-555.6	720920	1413(C)	720920	1419	0001	3400	120					
0-555.6	720921	1255			0001	1400	130					
0-555.6	720922	1325			0001	1200	130					
0-555.6	720923	1223			0001	2000	150					
0-547.9	720919	1520			0001	3800	140					
0-547.9	720919	1523			0001	2600	84					
0-547.9	720919	1526			0001	2500	62					
0-547.9	720920	1330			0001	5400	280					
0-547.9	720920	1333			0001	1300	62					
0-547.9	720920	1336			0001	870	70					
0-547.9	720921	1315			0001	870	80					
0-547.9	720922	1245			0001	9500	540					
0-547.9	720922	1248			0001	6400	210					
0-547.9	720922	1251			0001	1200	16					
0-547.9	720923	1140			0001	740	80					
0-547.9	720923	1143			0001	870	40					
0-547.9	720923	1146			0001	580	32					
0-545.0	720919	1620			0001	2700	74					
0-545.0	720919	1622			0001	2700	110					
0-545.0	720919	1624			0001	3000	76					
0-545.0	720920	1250			0001	1700	77					
0-545.0	720920	1252			0001	1500	120					
0-545.0	720920	1254			0001	1500	80					
0-545.0	720921	1339			0001	1200	60					
0-545.0	720922	1208			0001	360	52					
0-545.0	720922	1210			0001	540	26					

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 1113S050

STATION	DATE	TIME	DATE	TIME	DEPTH	31501 TOT COLI MFIMENDO /100ML	31616 FEC COLI MFM-FCBR /100ML	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L	01051 LEAD PB,TOT UG/L	01092 ZINC ZN,TOT UG/L
0-545.0	720922	1212			0001	490	28					
0-545.0	720923	1055			0001	390	36					
0-545.0	720923	1057			0001	660	30					
0-545.0	720923	1059			0001	440	18					
0-542.0	720919	1645			0001	2800	98					
0-542.0	720920	1235			0001	2000	90					
0-542.0	720921	1350			0001	1100	76					
0-542.0	720922	1155			0001	420	48					
0-542.0	720923	1040			0001	310	34					
0-540.4	720919	1655(C)	720919	1704	0001	4100	90					
0-540.4	720920	1150(C)	720920	1156	0001	680	110					
0-540.4	720921	1400			0001	420	110					
0-540.4	720922	1140(C)	720922	1145	0001	510	42					
0-540.4	720923	1018(C)	720923	1024	0001	340	26					
0-533.8	720919	1740(C)	720919	1748	0001	4900	88					
0-533.8	720920	1108(C)	720920	1114	0001	1000	140					
0-533.8	720921	1418			0001	1100	74					
0-533.8	720922	1120			0001	340	46					
0-533.8	720923	1000			0001	480	70					
0-532.3	720920	1030(C)	720920	1036	0001	1400	140					
0-532.3	720921	1430			0001	760	70					
0-532.3	720922	1115			0001	620	58					
0-532.3	720923	0950			0001	460	96					
0-530.0	720919	1905(C)	720919	1913	0001	2600	88					
0-530.0	720920	0940(C)	720920	0948	0001	1100	110					
0-530.0	720921	1500			0001	420	58					
0-530.0	720922	1021(C)	720922	1029	0001	640	80					
0-530.0	720923	0852(C)	720923	0900	0001	1200	90					
KC	720921	1500(C)	720922	1200				25K	100K	60	100K	20

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 1113S050

STATION	DATE	TIME	DATE	TIME	DEPTH	31501 TOT COLI MFIMENDO /100ML	31616 FEC COLI MFM-FCBR /100ML	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L	01051 LEAD PB,TOT UG/L	01092 ZINC ZN,TOT UG/L
KC	720922	1315				1600L	800L					
KC	720922	1200(C)	720923	0945				25K	100K	75	100K	25
M&T	720921	1200				690	2K					
M&T	720922	1115				2500	8					
M&T	720921	1200(C)	720922	1115				25K	100K	40	100K	20
M&T	720923	1045				600	1	25K	100K	40	100K	20
DC	720921	1045				4	4K					
DC	720922	1030				3K	3K					
DC	720921	1045(C)	720922	1030				25K	100K	50	100K	12
DC	720923	1000				8	2K					
DC	720922	1030(C)	720923	1000				25K	100K	45	100K	12
LK	720922	0900				4	2	25K	100K	40	100K	100
LK	720921	0900(C)	720922	0900				25	100K	40	100K	180
CK	720921	1330				55000000	14000000					
CK	720922	1330				.120E+09	24000000					
OP	720919	0915				16000000	910000					
OP	720919	0945				12000000	360000					
OP	720920	0845				27000000	1900000					
CH	720920	1000						3K	50K	60	38	150
CH	720919	1100(C)	720920	1000				3K	50K	50	26	130
HA	720919	1255				100K	10K					
HA	720920	1120				1000K	100K					
VE	720920	1615(C)	720921	1030				3K	50	50K	10K	90

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 1113S050

STATION	DATE	TIME	DATE	TIME	DEPTH	31501 TOT COLI MFIMENDO /100ML	31616 FEC COLI MFM-FCBR /100ML	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L	01051 LEAD PB,TOT UG/L	01092 ZINC ZN,TOT UG/L
VE	720921	1045				1000K	100K					
MA-EFF	720919	1450	(C)720920	1200				69	660	165	78	1300
MA-EFF	720920	1205						3K	450	90	23	520
MA-EFF	720920	1210				86000000	3300000					
MA-EFF	720921	0920				7300000	35000					
MA-EFF	720921	0930						7	600	85	50	4300
MA-EFF	720920	1200	(C)720921	0930				3	570	85	55	1200
MA-INF	720920	1205						3K	450	130	34	610
MA-INF	720921	0930						4	500	110	10K	1800

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 1113S050

STATION	DATE	TIME	DATE	TIME	DEPTH	01102 TIN SN,TOT UG/L	00500 RESIDUE TOTAL MG/L	00530 RESIDUE TOT NFLT MG/L	00535 RESIDUE VOL NFLT MG/L	00058 FLOW RATE GPM	00335 COD LOWLEVEL MG/L	00340 COD HI LEVEL MG/L
KC	720921	1500(C)	720922	1200			576	40	32	278.00	4.4	
KC	720921	1500(C)	720922	1200		1500K						
KC	720922	1200(C)	720923	0945			545	12	11	278.00	4.0	
KC	720922	1200(C)	720923	0945		1500K						
M&T	720921	1200(C)	720922	1115			1667	7	5K	2260.00		113
M&T	720921	1200(C)	720922	1115		2500						
M&T	720923	1045				3850	2140	32	8	2260.00		200
DC	720921	1045(C)	720922	1030			1947	6	5	4000.00	39.0	
DC	720921	1045(C)	720922	1030		1500K						
DC	720922	1030(C)	720923	1000			1900	5K	5K	4000.00	20.0	
DC	720922	1030(C)	720923	1000		1500K						
LK	720922	0900				1500K						
LK	720921	0900(C)	720922	0900			650	6	5K	1050.00		55
LK	720921	0900(C)	720922	0900		1500K						
CK	720921	1330(C)	720922	1330			719	66	14	190.00		380
OP	720919	0930(C)	720920	0830			840	130	105			400
CH	720919	1100(C)	720920	1000			670	60	55			290
HA	720919	1300(C)	720920	1100			1050	215	175			310
VE	720920	1615(C)	720921	1030			1100	8	6			40K
MA-EFF	720919	1450(C)	720920	1200			1250	230	185			530
MA-EFF	720920	1200(C)	720921	0930			1200	150	125			430

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY
AGENCY - 1113S050

STATION	DATE	TIME		DATE	TIME	DEPTH	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO
O-600.6	720919	0900	(C)	720919	0908	0005	8	393
O-600.6	720920	1908	(C)	720920	1916	0005	4	397
O-600.6	720921	0925				0005	7	397
O-600.6	720923	1538				0005	4	400
O-595.0	720920	1755				0005	4	405
O-595.0	720920	1758				0005	3	405
O-595.0	720920	1801				0005	3	394
O-595.0	720921	0957				0005	6	381
O-595.0	720923	1515				0005	4	426
O-587.7	720919	1103				0005	6	409
O-587.7	720920	1720				0005	5	411
O-587.7	720921	1017				0005	5	381
O-587.7	720923	1452				0005	4	398
O-582.7	720919	1145	(C)	720919	1153	0005	6	404
O-582.7	720920	1650	(C)	720920	1658	0005	5	416
O-582.7	720921	1040				0005	4	398
O-582.7	720923	1425				0005	5	398
O-574.0	720919	1235				0005	8	398
O-574.0	720920	1615				0005	4	411
O-574.0	720921	1100				0005	6	398
O-574.0	720923	1355				0005	4	436
O-566.3	720919	1300				0005	7	409
O-566.3	720920	1547				0005	5	417
O-566.3	720921	1124				0005	6	379
O-566.3	720923	1327				0005	5	397
O-561.0	720919	1325				0005	8	412
O-561.0	720919	1327				0005	8	409

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 11135050

STATION	DATE	TIME		DATE	TIME	DEPTH	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO
0-561.0	720919	1330				0005	8	407
0-561.0	720920	1515				0005	5	412
0-561.0	720920	1517				0005	5	418
0-561.0	720920	1520				0005	5	413
0-561.0	720921	1140				0005	8	391
0-561.0	720923	1305				0005	7	377
0-555.6	720919	1445	(C)	720919	1452	0005	10	421
0-555.6	720920	1413	(C)	720920	1419	0005	6	398
0-555.6	720921	1255				0005	6	390
0-555.6	720922	1325				0005	7	422
0-555.6	720923	1223				0005	7	461
0-547.9	720919	1520				0005	8	427
0-547.9	720919	1523				0005	7	420
0-547.9	720919	1526				0005	8	428
0-547.9	720920	1330				0005	8	379
0-547.9	720920	1333				0005	5	380
0-547.9	720920	1336				0005	5	375
0-547.9	720921	1315				0005	7	405
0-547.9	720922	1245				0005	7	420
0-547.9	720922	1248				0005	5	442
0-547.9	720922	1251				0005	7	444
0-547.9	720923	1140				0005	9	477
0-547.9	720923	1143				0005	8	459
0-547.9	720923	1146				0005	7	469
0-545.0	720919	1620				0005	7	418
0-545.0	720919	1622				0005	7	412
0-545.0	720919	1624				0004	10	422
0-545.0	720920	1250				0005	8	390
0-545.0	720920	1252				0005	7	402
0-545.0	720920	1254				0005	6	394
0-545.0	720921	1339				0005	7	410
0-545.0	720922	1208				0005	9	442
0-545.0	720922	1210				0005	7	443

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 11135050

STATION	DATE	TIME		DATE	TIME	DEPTH	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO
O-545.0	720922	1212				0005	7	440
O-545.0	720923	1055				0005	8	474
O-545.0	720923	1057				0005	8	478
O-545.0	720923	1059				0005	7	480
O-542.0	720919	1645				0005	8	420
O-542.0	720920	1235				0005	8	408
O-542.0	720921	1350				0005	7	380
O-542.0	720922	1155				0005	8	453
O-542.0	720923	1040				0005	9	455
O-540.4	720919	1655	(C)	720919	1704	0005	8	407
O-540.4	720920	1150	(C)	720920	1156	0005	7	404
O-540.4	720921	1400				0005	7	406
O-540.4	720922	1140	(C)	720922	1145	0005	7	453
O-540.4	720923	1018	(C)	720923	1024	0005	7	448
O-533.8	720919	1740	(C)	720919	1748	0005	10	404
O-533.8	720920	1108	(C)	720920	1114	0005	8	415
O-533.8	720921	1418				0005	6	431
O-533.8	720922	1120				0005	10	456
O-533.8	720923	1000				0005	10	443
O-532.3	720920	1030	(C)	720920	1036	0005	8	415
O-532.3	720921	1430				0005	6	422
O-532.3	720922	1115				0005	9	451
O-532.3	720923	0950				0005	9	443
O-530.0	720919	1905	(C)	720919	1913	0005	15	391
O-530.0	720920	0940	(C)	720920	0948	0005	8	409
O-530.0	720921	1500				0005	5	434
O-530.0	720922	1021	(C)	720922	1029	0005	12	524
O-530.0	720923	0852	(C)	720923	0900	0005	10	379
OP	720919	0930	(C)	720920	0830			1250
CH	720919	1100	(C)	720920	1000			950
MA	720919	1300	(C)	720920	1100			1500

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SURVEILLANCE AND ANALYSIS DIVISION ATHENS, GEORGIA

OHIO RIVER (MCALPINE POOL) FIELD STUDY

AGENCY - 11135050

STATION	DATE	TIME		DATE	TIME	DEPTH	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO
VE	720920	1615	(C)	720921	1030			1500
MA-EFF	720919	1450	(C)	720920	1200			1350
MA-EFF	720920	1200	(C)	720921	0930			1600

APPENDIX D

REGION V REPORT ON
INDIANA ARMY AMMUNITION PLANT

REPORT ON WASTE DISPOSAL FACILITIES AT FEDERAL INSTALLATIONS

DEPARTMENT OF THE ARMY
INDIANA ARMY AMMUNITION PLANT

DATE OF REPORT: January 6, 1972

ENVIRONMENTAL PROTECTION AGENCY
REGION V

1 NORTH WACKER DRIVE
CHICAGO, ILLINOIS 60606

A visit was made to the Indiana Army Ammunition Plant, Charlestown, Indiana, on September 30, 1971, by Messrs. Harry Maroney, and Irving Bernstein, of the U. S. Environmental Protection Agency, Region V, Chicago, Illinois, to inspect previously recommended improvements contained in "Report on Waste Disposal Practices at Indiana Army Ammunition Plant", dated May 1, 1969, conducted by the Federal Water Pollution Control Administration, Ohio Basin Region, and to observe current operations. The following persons were in attendance:

1. Indiana Army Ammunition Plant:

Lt. Col. W. F. Crews	Commanding Officer
Mr. Maurice Mennen	Executive Assistant
Mr. W. W. Struck	Operations Review
Mr. T. R. Owen	Industrial Specialist

2. Olin Inc.

Mr. B. C. Baldridge	Resident Manager
Mr. W. Rice	Director, Engineering
Mr. E. L. Allen	Engineer
Mr. H. D. Foster	Engineer

I. General Description:

The Indiana Army Ammunition Plant is located in Clark County, Indiana, approximately 1/4 mile south of Charlestown. The installation consists of 1,390 buildings located on approximately 10,600 acres, the terrain being flat to slightly rolling, and situated on bluffs above the Ohio River. The major portion of the drainage flows to three minor tributaries of the Ohio River, namely, Jenny Lind Run, Battle Creek, and Lentzier Creek.

The present population numbers approximately 4,500 employees. The manufacturing plant has been reduced to five hundred (500) employees, and the present employment at the loading plant is 4,000. The population figure includes approximately 60 persons living in housing areas on the plant site.

Subject: Report on Waste Disposal Facilities at Indiana Army Ammunition Plant

The primary mission of IAAP is the manufacture of single base propellants and the loading of cannon and mortar propellants. Formerly, Indiana Army Ammunition Plant was operated as two separate plants, designated as Indiana Ordnance Works (the propellant manufacturing plant), and Hoosier Ordnance Plant (the loading plant).

A. Responsible Agency:

The installation is Government Owned(Army) Contractor Operated, (Olin Corporation), and is directly under control of the U. S. Army Ammunition Procurement and Supply Agency, Joliet, Illinois.

B. Dates of Visit:

September 30, October 1, 1971

C. Background Data:

1. Receiving Waters: Industrial wastes are discharged to Jenny Lind Run, then to the Ohio River. Sanitary wastes are discharged to the Jenny Lind Flume, and then Jenny Lind Run, or to the Ohio River directly. Storm waters drain to Jenny Lind Run, tributary to the Ohio River, or to Lentzier Creek.

2. Waste discharge flows: Present, 333,000GPD Sanitary wastes (253,000 HOP and 80,000 IOW). The average flow of the industrial waste is approximately 1,287,000 GPD, which includes an unknown quantity of springwater infiltration. The major portion of the industrial waste is generated in the HOP production, since IOW activities have been curtailed.

II. Waste Treatment Facilities and Practices:

A. Separate storm, sanitary and industrial waste sewer systems are installed.

1. Storm Sewer: Storm water drainage in the IOW area is in most part from roof surfaces, either directly, or via gutters, and downspouts, parking areas, surface roads, unimproved land, etc., by natural runoff to two parallel 48" diameter storm sewers, then to the Jenny Lind Run, tributary to the Ohio River. Storm water drainage in the HOP area is by natural runoff, and a series of ditches to Lentzier Creek.

Subject: Report on Waste Disposal Facilities at Indiana Army Ammunition Plant

2. Sanitary Wastes: All sewage generated at IAAP is treated at the IOW and HOP sewage treatment plants and numerous septic tank facilities, as follows:

a. IOW sewage treatment plant. This primary treatment plant serves the entire propellant manufacturing area and is currently operating at a reduced level, since the production of single base propellant has ceased. The plant has been designed for a population equivalent of 10,000, and the sanitary waste is generated in the administrative and shop areas.

Performance of all equipment is satisfactory and no appreciable odor prevailed. The plant consists of the following equipment: Bar screen, two primary settling tanks with mechanical scrapers, two anaerobic digesters (one heated with fixed cover, and the other open), and four sludge drying beds. The plant effluent flow is monitored by utilizing a flow recorder and V-notch weir, and is discharged to Jenny Lind Lagoon without benefit of chlorine contact chamber or plant effluent chlorination. However, the sewage in the primary tank is dosed with hypochlorite. Jenny Lind Lagoon is elevated and diked, and the spillover is aerated in flowing to a lower level lagoon. The two lagoons are known as Jenny Lind Run, tributary to the Ohio River. The plant effluent discharged was observed to be clear, colorless,odorless, and exhibited no signs of floating oil, grease or scum.

A typical plant effluent analysis is listed below:

November 1971

	Monthly Average
BOD	7.7 PPM
pH	8.0
Dissolved Oxygen	11.0 PPM*

*Stream Analysis

The BOD concentration of 7.7 PPM is at a minimum of 25% of that to be expected from a primary treatment plant. The low concentration could be due to infiltration and dilution of the waste waters from the vehicle wash rack. The BOD discharged from

the plant is not degrading the waters of the lagoon, since the dissolved oxygen in the stream approaches saturation.

b. HOP Sewage Treatment Plant. This secondary sewage treatment plant provides services for the loading area. The plant was designed for a population equivalent of 9,000, and an average flow of 1.25 MGD, and consists of a "Bio-Activation Process", combining a trickling filter and activated sludge treatment. Components include lift station, comminutor, bar screen, Parshall flume, two primary tanks, dosing chamber, high rate rotary trickling filter (no mercury seal), aeration tank, intermediate and final settling tanks, aerobic digester, six (6) sludge drying beds, three plant effluent pumps, and an eight-inch force main to the Ohio River. There are two streams of raw sewage influent to the sewage treatment plant. The one originating in the bag manufacturing area flows by gravity, and the other is pumped to the sewage treatment plant. The lift station and final settling tanks have bypassing facilities to the Lenzier Creeks. There is no chlorine contact chamber. Chlorination is provided in the effluent lift station wet well and a pipe three miles long is utilized to obtain the required detention time. The plant effluent discharged was observed to be clear, colorless, odorless, and exhibited no signs of floating oil, grease or scum. There is no recording instrumentation. Flow is calibrated from the height on V-notch weir.

A typical plant effluent analysis is listed below for November 1971:

	Monthly Average
BOD	2.2 PPM
pH	7.4
Dissolved Oxygen	12.0

The BOD concentration is too low for the degree of treatment provided, which could signify that infiltration is affecting the results.

c. Septic Tanks: Domestic wastes from the military housing River Ridge Area (49 houses - 160 persons) are discharged to three septic tanks. These tanks do not have terminal drainfields, and the effluent is discharged directly to the Ohio River, without disinfection or other treatment. Approximately 100 additional septic tanks exist at Indiana Army Ammunition Plant,

the major portion of which have been replaced by sanitary sewer connection to the treatment plant.

d. Cafeteria: Currently, the cafeteria cooking facilities are not being utilized. Food is delivered by a Louisville caterer, and only dishes are washed. Solid wastes are disposed of in a container and removed and disposed of by the caterer with his facilities. The building is fitted with grease traps.

e. Automobile Service Station: All crankcase oil from the servicing operation is recovered and disposed of by sale. Motor oil is reprocessed.

f. Vehicle Maintenance Area: The locomotive repair shop, Building 718, has floor drains in the service pits which lead to the sanitary sewer. The building is equipped with traps to intercept grease and oil. There are two wash racks in Building 2552, the effluent from which (emulsified oil and grease) is also discharged to the sanitary sewer. Traps have been installed to intercept any oil before discharge to the sewer.

g. Laundry wastes from Building 1021 are discharged to a baffled settling tank, which overflows into the sanitary sewer system. The waste contains detergent and some lint.

3. Industrial Wastes:

a. Bag Loading: The bag loading plant (HOP) is currently active. The operations consist of the fabrication of a cloth bag, and the loading of mortar and cannon propellant into these bags. The latter are manufactured from purchased cloth and made to various bag sizes by sewing machine operators at the plant. Also, paper tubes are manufactured for the packaging of the propellant bags, before inserting them into a box for shipment to an ammunition loading plant. Also, titanium dioxide is purchased and blended with a wax compound. This material is utilized for gun tube protection. No appreciable amounts of industrial waste are generated from the above operations.

b. Propellant Manufacturing: (IOW). The plant is currently in an inactive status, but when operative, includes the manufacture of smokeless cannon and mortar propellants and

support acids (nitric and sulfuric), which are as follows:

1. Nitrocellulose is produced by the interaction of wood pulp and/or cotton linters and nitric acid. In this process sulfuric acid is used as a dehydrating agent.

2. In the next step, ether and alcohol are used as a drying agent to remove water from the nitrocellulose. The dry, lumpy material formed is extruded through a die, forming strands approximately 4 feet long, which are then cut to grain size about 3/4 inch long.

3. Nitric acid is manufactured by the oxidation of ammonia gas (AOP process), and sulfuric acid by the burning of sulfur to sulphur dioxide, and subsequent oxidation to sulfur trioxide in the presence of a vanadium pentoxide catalyst. The sulfuric trioxide is collected in water to form sulfuric acid.

The wastes from the propellant lines, and sulfuric and nitric acid plants are discharged to the industrial waste sewer system, which leads to the Jenny Lind Flume. The acid wastes include sulfuric and nitric acids. Other wastes which enter Jenny Lind Flume include nitrocellulose and other organic materials from the propellant lines (ether and alcohol, butylthalate, diphenyl, etc.). Lime is added to both lines for neutralization (controlled manually), based on pH readings taken near the junction of Jenny Lind Run and the Ohio River.

c. Cooling towers are used in the loading plant to condition air. A closed loop system is used with a minimum of blowdown. Copper piping is used in the system, and consequently no corrosion inhibitors or fungicides are required.

d. Indiana Army Ammonition Plant has two powerhouses (in an inactive status) which contain boilers, air compressors electrical generators and other supporting equipment. Each powerhouse is operated in conjunction with a cooling tower and reservoir. The water reaching the boiler room receives treatment with ferric sulfate, and the coagulated solids are removed in a precipitator. The effluent is then discharged to an anthrafelt filter, and then a clear well. The boiler make up water (clear well effluent) then receives additional treatment in a zeolite softener. Backwash from the zeolite softener (calcium and

magnesium chloride), and anthrafelt filter, precipitator sludge (ferric hydroxide), coal ash, and boiler blow down are discharged to a sump which overflows to the lagoon. There are numerous other package steam and hot water boiler plants scattered over Indiana Army Ammunition Plant. The make up water for these boiler plants is treated with a chelating agent, and receives subsequent conditioning in a zeolite softener. The boiler blowdown, and softener regeneration wastes are discharged to an impervious clay bottom, land locked settling basin.

III. Storage of Hazardous Material

There are two 18,000 gallon fuel oil storage tanks which do not have sufficient diked capacity to contain the full content of each tank in the event of a major spill. The fuel oil storage tank farm is also diked. Numerous other oil storage tanks are either diked or installed underground. The acid tanks (sulfuric, nitric and mixed acid)are not diked, but any spillage would be discharged into the process sewer lines, receive subsequent neutralization, and sulfate precipitation treatment, before discharge to the receiving stream. Ether, alcohol, and ammonia tanks are not diked.

There are numerous above ground storage magazines for storage of loaded propellant bags at ambient temperature. Any spillage in these magazines would be on a dry basis. In the event of a spill, the powder could be swept up and taken to the disposal ground.

IV. Improvements Proposed by Indiana Army Ammunition Plant:

The following improvements will be, or have been, made consistent with the recommendations contained in the May 1, 1969 FWPCA Report, and the U. S. Army Environmental Hygiene Agency, Edgewood Arsenal, Maryland, Sanitary Engineering Survey, Indiana Army Ammunition Plant, Charlestown, Indiana:

1. Improved ventilation in chlorine cylinder storage room Building 403-2.

2. Provided Bureau of Mines - approved respiratory protective masks in the chlorine cylinder storage room, Building 403-2, cooling tower chlorinatio room and Building 6001 (HOP well water chlorination facilities).

3. Installation of Standard Methods, (OTA) procedure to determine free available chlorine residual in progress.

Subject: Report on Waste Disposal Facilities at Indiana Army Ammunition Plant

4. Completed 65% of a survey to establish the points where storm waters could enter the sanitary sewer system and other sources of infiltration.

5. Provided multiplication factors for calculating flow from the continuous recorder at HOP Sewage Treatment Plant. The factors have been placed on the instrument.

6. Conducted a study as to the best approach to provide the degree of treatment required (secondary) in the River Ridge septic tank area. The conclusion reached is that the only method to cope with the problem is the construction of two new package aeration treatment plants. Accordingly, FY'72 funds have been requested to construct these facilities. Completion is expected in FY '73.

7. FY '71 funds ($5,000) were requested for the design of the package type aeration treatment facilities to replace septic tanks. FY '72 (MCA) funds ($89,000) have been requested to construct these facilities.

8. Provided chlorination facilities for the HOP Sewage Treatment Plant.

9. The dried sludge disposal area has been relocated from a position where it could be a source of water pollution, especially during heavy and prolonged rainfall.

10. FY '72 - '74 Funds have been requested for integrating and totalizing flow recorders for both sewage treatment plants. Included also is the purchase and installation of an automatic (Technicon) sampler. The monitor will be located between the lower settling pond and the Ohio River.

11. FY '74 funds will be requested to reroute the HOP Sewage Treatment Plant lift station and final settling tank by pass lines, and sludge bed effluent piping to a new lift station. The latter will pump any sanitary wastes from these sources to the head of the sewage treatment plant. The pumps will be driven by a liquified petroleum internal combustion engine, and serve in a stand by capacity for use during a power failure.

12. The updating of the IOW sewage treatment plant from primary to secondary treatment is scheduled for completion during FY '72. Included in the new facilities are a trickling filter, final settling tanks and chlorination facilities.

13. Grease traps have been installed in Buildings 401-2, 718, and 2552.

14. The settling tank baffles at the laundry, Building 1021, have been repaired.

15. Upon resumption of manufacturing operation, an industrial waste monitoring program will be provided.

16. Funds have been requested to enlarge the dike capacity for the 18,000 gallon fuel oil storage tanks to hold at least the contents of each tank.

17. Replaced septic tank at Building 2558 with line to sewage treatment plant.

V. Recommendations:

1. The existing practice of neutralizing industrial wastes with lime be augmented with facilities for removing the nitrate ion. Under present conditions industrial wastes are neutralized with lime before discharge to the Ohio River. Most of the sulfate is removed by precipitation, but the nitrate ion is discharged to the river unaffected by treatment. This project should be initiated if and when the production of cannon and mortar propellant is resumed.

2. Consideration be given to diking of the ether, alcohol and ammonia tank at the IOW plant, upon resumption of operation.

3. The raw and treated sanitary and industrial waste be monitored on a regular basis.

4. A testing program be established which should include 5 day BOD, suspended and settleable solids, pH and chlorine residual. For the HOP sewage treatment plant, in addition to the above tests, sludge index and colorimetric dissolved oxygen should be run. BOD of the raw wastes and final effluent be determined at least once a week, preferably twice a week, (3 hour composites) taken at 11:00 A.M., 12:00 Noon, and 1:00P.M., suspended solids of raw waste and final effluent at least once a week at the same hours, settleable solids once or twice a week at representative flows.

Chlorine residual of the effluent daily, Monday through Friday, twice daily when stream conditions require, sludge index and colorimetric dissolved oxygen test weekly.

Daily monitoring be conducted on the combined effluent at the junction of Jenny Lind Run and the Ohio River for flow, BOD, COD, pH, suspended solids, dissolved solids, and nitrates.

5. The discharge of septic tank effluent to the Ohio River be curtailed as expeditiously as possible.

6. The overflow line from the boiler plant water treatment sump be diverted from the lagoon to the sanitary sewer. It is conceivable that during heavy rainfall there could be a discharge to the lagoon.

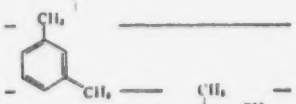
APPENDIX E

ORGANIC COMPOUNDS IDENTIFICATION

CHEMICAL SERVICES BRANCH
SAD, EPA, REGION IV
ATHENS, GEORGIA 30601

ORGANIC COMPOUNDS IDENTIFIED

PROJECT Ohio River - McAlpine Pool SAMPLING DATE September 1972

SAD Number	Industry or Source	Organic Compound	Conc. Found mg/L	Chemical Formula	Chemical Class	Solubility	Stability
0340A	Dow	decamethylcyclopentasiloxane	0.023		organosilicon	unknown	
0340A	Dow	The sample appears to contain octamethylcyclopentasiloxane however no standard is available for verification.					
0341	M&T	tri-n-butyl-phosphine oxide	<0.1	$(CH_3(CH_2)_3)_3PO$	organo-phosphorus	unknown	
0423	M&T	tri-n-butyl-phosphine oxide	<0.2		organo-phosphorus	unknown	
0423	"	m-xylene	0.15		xylene	insoluble in water	
0423	"	o-xylene	0.091		xylene	insoluble in water	
0423	"	o-cresol	0.13		phenol	readily water soluble	

Preceding page blank

APPENDIX F

Personnel Roster
Ohio River (McAlpine Pool) Study

David W. Hill - Study Director

Charles Sweatt - Project Engineer (Field)

Tom Bennett - Project Chemist (Lab)

Herbert Barden - Project Microbiologist (Lab)

Tom Sack - Physical Science Technician (Lab)

W. R. Davis - Chemist (Field)

Hugh Vick - Chemist (Field)

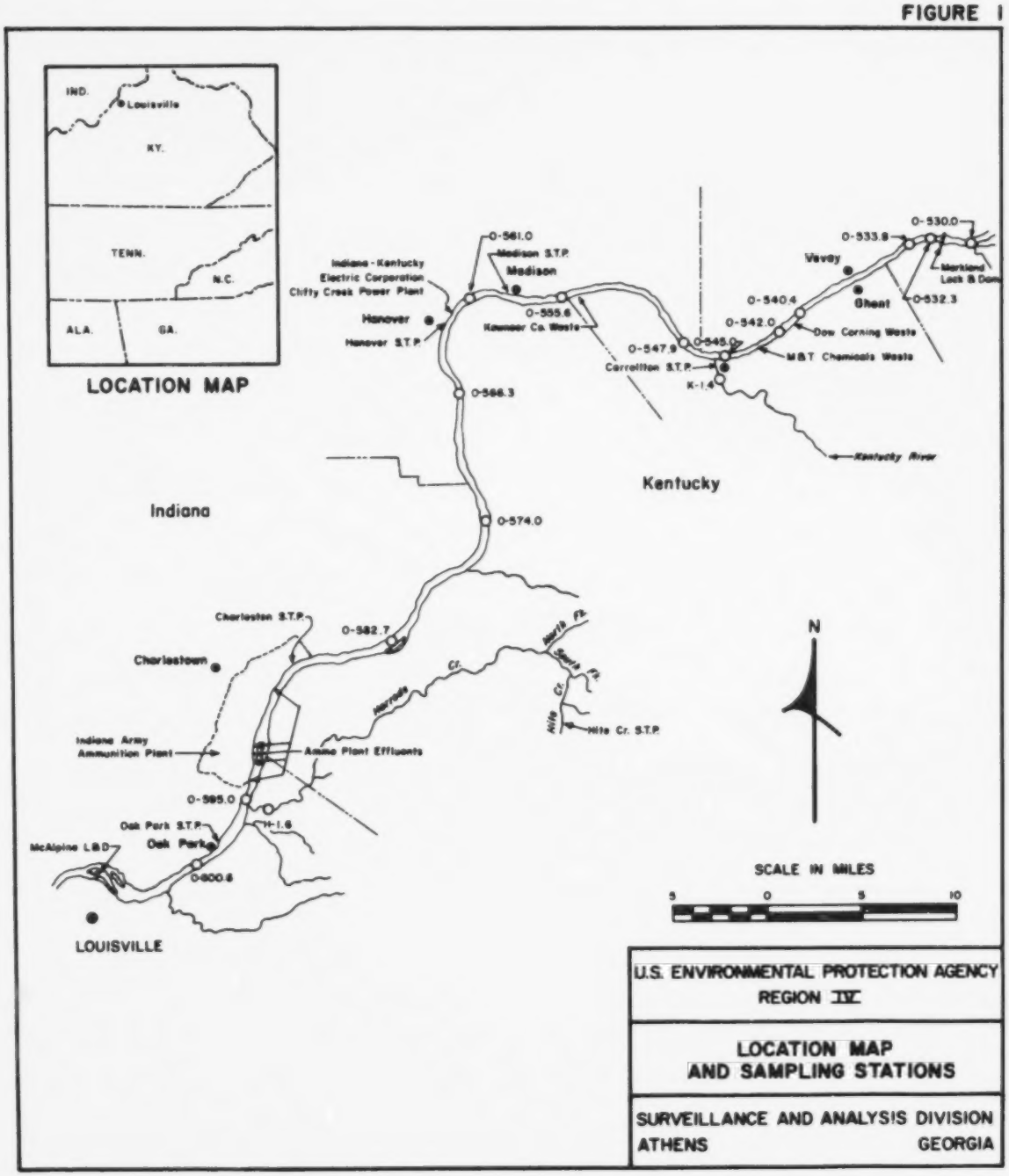
Ray Wilkerson - Hydraulics Engineering Technician (Field)

Eddie Shollenberger - Engineering Technician (Field)

E. Chaudoir - Hydrologist (Evansville)

S. Paulson - Engineering Technician (Evansville)

FIGURE 1



* U.S. GOVERNMENT PRINTING OFFICE : 1973 748—252/3203 Region 4